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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

[OFFICIAL NOTICE.]

Twenty-seventh Annual Meeting, American Gas Light Association.

GENERAL ANNOUNCEMENT.

OFFICE OF THE SECRETARY,
NEW YORK, Sept. 7, 1899.

There will be an annual meeting of the American Gas Light Association held at New York city, October 18th, 19th and 20th, 1899. The meeting will be called to order by the President, Mr. Alex. C. Humphreys, of New York city, at 10 A.M., Wednesday, October 18th, in the meeting hall, which will be in Sherry's new building, corner of Fifth avenue and Forty-fourth street.

The headquarters will be at the Herald Square Hotel, Thirty-fourth street, between Broadway and Seventh avenue. This is a new hotel, to be opened October 1st. All members should get rooms at headquarters.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed stamped envelope should be enclosed, as misunderstandings may thereby be averted. If you write before October 5th, address Mr. C. F. Wildey, Cosmopolitan Hotel, New York city.

The Herald Square Hotel will be conducted on the European plan, and rates for rooms will be as follows:

Rooms without bath occupied by one person, from $1.50 to $2.50 per day; rooms with bath, occupied by one person, from $2.50 to $4 per day. When room is occupied by two persons the total charge in every case will be $1 more per day than when the same room is occupied by one person; that is, $2.50 for $1.50 rooms, and so on. Members of the Association occupying rooms without bath will have the privilege of using the general bath rooms, with which each floor is provided, free of charge.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name and address, etc., as these appear on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of application for membership accompanies this circular. More can be obtained of the Secretary. Remember, all applications must be in the Secretary's hands, by October 8th at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"Another View of Interior Illumination," by Mr. F. N. Morton, Hoboken, N. J.

"The Steam Consumption of a Water Gas Plant," by Mr. Alten S. Miller, New York city.

"The Pumping of Gas," by Mr. George J. Roberts, Phila., Pa.

A paper by Mr. A. G. Glasgow, of London, England; and a paper by Mr. Rollin Norris, of Phila., Pa. The titles of these last two papers

have not yet been announced. There will probably also be a paper bearing upon prepayment meters.

A lecture will be delivered to the Association by Dr. Henry Morton, President of the Stevens Institute of Technology, Hoboken, N. J., upon a subject of interest to the members.

During the days of the meeting all the announcements will be posted on the bulletin boards at the hotel and in the meeting room. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work by affording a ready means of recognition.

In order that the Year Book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that if any of the speakers at this meeting desire to correct their remarks before they are printed they will be given an opportunity before leaving New York city, but not after. The stenographer will have type written copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned into the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted—viz., full fare going and one third fare returning—by the several Passenger Associations named and under the conditions noted :

The Trunk Line Passenger Committee, covering territory west of New England and East of Niagara Falls, Buffalo and Salamanca, N. Y., Pittsburg, Pa. ; Bellaire, O. ; Wheeling, Parkersburg, and Charleston, W. Va.

The New England Passenger Association, covering nearly all of the lines in the New England States.

The Central Passenger Association, covering the territory bounded on the east by Pittsburg, Salamanca, Buffalo and Toronto ; on the north by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook county, Ills.; on the west by the west line of Cook county and the Illinois and Mississippi rivers to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis ; and on the south by the Ohio river, including points on either side of that river.

The Southeastern Passenger Association, covering the territory south and west of the Virginias and south and east of the Ohio and Mississippi rivers.

The Western Passenger Association, covering the territory west of and not including Chicago, Peoria and St. Louis ; in other words, the territory west of that of the Central Association.

[Here follows instruction by the Secretary as to the conditions under which the one and one-third fare for the round trip may be obtained. These conditions are practically similar to those that have heretofore obtained.]

SPECIAL.

If sufficient numbers of subscriptions are obtained the social programme will be as follows :

Thursday evening a banquet, to which ladies will be admitted on equal footing with the gentlemen. Friday, a steamboat ride around New York harbor. Tickets admitting members and friends to these entertainments can be had for $5 each. If you wish to join in them please sign enclosed card and return it to the Secretary at once. It will be necessary to have at least 200 subscriptions.

Be sure to obtain a railroad certificate when buying your ticket for New York, as the greater the number of certificates handed in the easier it is to get the reduction in rates for future meetings. Apply for ticket and certificate at least 30 minutes before train time.

Each person must sign his own certificate at time of purchasing tickets for New York. Be sure to hand the Secretary your certificate as soon as you reach the headquarters. Apply for return ticket at least 30 minutes before train time and have your certificate with you. All persons, ladies included, attending the meeting are entitled to the reduced rate from the territories named.

Members will please hand their certificates to the Secretary, or his clerk, upon arrival at place of meeting. If there are 100 members present holding certificates each certificate will then be properly endorsed, and handed back to owner before adjournment.

Keep this circular in your pocket and apply to it if you are in doubt.

ALFRED E. FORSTALL, Secy.

[Prepared for the JOURNAL.]

Topics for Gas Engineers.

By "ENGINEER."

Lubrication of Pumping Machinery.—The oil to be used on the bearing surfaces of modern pumping machinery should be of the very best kind, having a good body and free from the tendency to gum. Several oils, when pure, will answer for this purpose, but after all there is quite a wide difference even among them. Castor oil is sometimes used, but the writer could never see any special feature of this oil, aside from its body, which should make one prefer it to other oils. In fact, I think that its excessively heavy body is one of the chief reasons why it should not be used for pump machinery, because the oil will not flow as readily as other oils with sufficiently good body. Double refined lard, sperm or neat's foot oil, will give satisfaction. Winter-white sperm oil will, of course, take a high place, but is very seldom got in its purity. Lard oil is in my estimation the poorest of the three, and while it may answer the purpose after some fashion it has not sufficient body to warrant its practical use. Bone tallow and tripe tallow are bought at low prices, and some engineers use these grades to the detriment of their machinery. Other tallows frequently contain nitrogenous animal tissue, and after this tissue decomposes, as it often does, the tallow becomes rancid.

Inferior Greases.—It may interest the engineering fraternity to know that, in several places visited by the writer, the conditions resulting from poor lubrication were due almost entirely to efforts which had been made to make the greases last longer by introducing adulterants. In one engine room the complete equipment of a pump was saturated with a cheap grease to such extent that some of the journals were hidden beneath black grease. The valves rattled, and some of the bearings were hot, causing the grease to melt and flow off. I found that a cheap axle grease was used for lubricating purposes, made from rosin oil and mineral oils with rosin lime soap. Fatty oils were used in the combination, forming a fairly good grease compound. This was the condition of the grease when delivered to the company ; but in order to make the grease go further the engineer put in large quantities of fatty matter, and as not enough free inert matter was added to make up for the increase in fatty matter, the grease would not stay on the bearings long enough to do much good. All of the stuff had to be scraped off, oil holes were cleaned out, journals washed off in lye water, and a grease substituted which possessed the needed quantities in weight and quality. After this the pump operated smoothly and with all bearings cool.

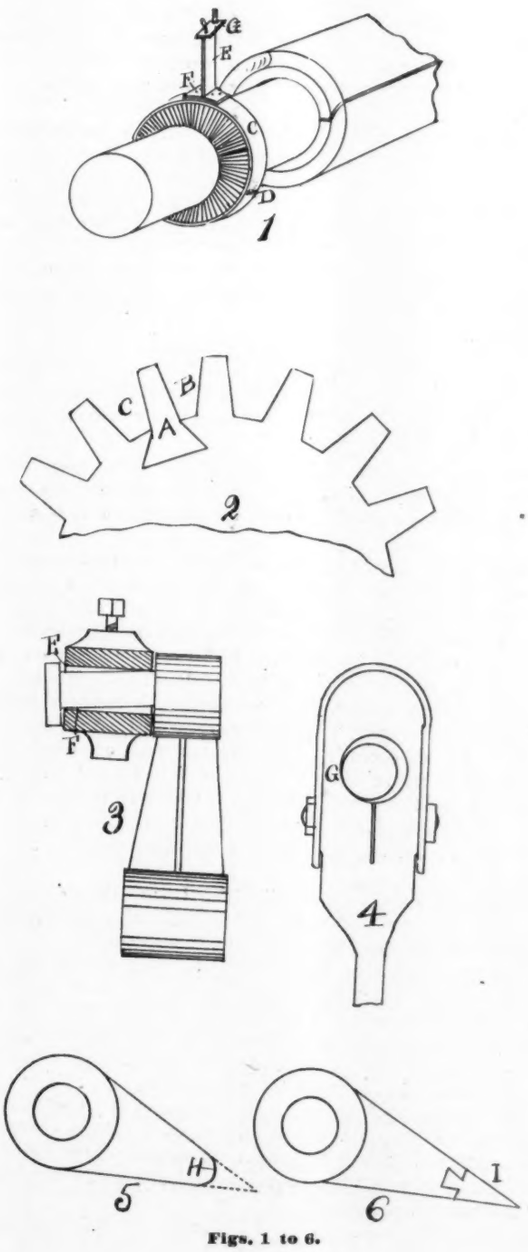
Oil Swab.—In Figure 1 is a plan for attaching a circular swab to a pump shaft next a bearing. A strip of filletting is purchased from brushmakers, of sufficient length to lap once around the shaft, and about 2 inches wide. The fillet is a leather back with bristles 1 inch long. The position of the fillet on the shaft is indicated by *C*, and the manner of jointing the ends at *D* is by sewing them together. The fillet is held in place by being attached at *F* to the bracket *E*, and this bracket is set screwed to the frame with a screw, *G*. The shaft can revolve in this arrangement and the bristles of the fillet will keep the shaft clear from acids and other liquids that happen to work their way along the shaft toward the shaft boxes.

This is a mistake that wastes oil, soils the cogs, and fails to effectively lubricate the gears, as most of the oil runs off to the floor. A good grease is better, if rightly applied. A little plumbago may be mixed with the grease for the coarser gears. A grease made of rosin oil and mineral oil, with proportions of rosin-lime soap, makes a good mixture. Some fatty oils should be added until a semi-solid, greasy compound is produced. Even the best of prepared greases will not work well if the gears are out of order. In one plant where the foreman complained of the lubricant furnished for use on the gearing, it was discovered that some of the gears contained plugged teeth, while in one case a broken tooth had been replaced with a cog dovetailed into the rim as shown at *A* in Fig. 2. The trouble was that the machinist had not made correct measurements and the cog was put in with too much space at *C* and too little at *B*, resulting in binding. After this was rectified by filing the gear ran correctly.

Crank Pin Untrue.—Sometimes the crank pin of the pump will become badly bent, as shown in Fig. 3. The sleeves bind as may be seen, with the result that the pin wabbles in its bearing and is badly scraped at *E F* by the shoulders of the sleeves. The box and surroundings are usually covered with black oil, which has been ground out from the box. The box should be taken apart, the grindings and soiled greases cleaned away, and new and correct sleeves put in, after which the box will run without grinding and heating. An examination

should be made to find out if the sleeves are worn, as at *G*, Fig. 4, in which case new bushings should be provided.

A Slipping Pawl.—In Fig. 5 is a sample of a pawl so badly worn at its tip *H*, as to permit the pawl to ride over the teeth of the gear below. Strange to say, the engineer accredited the trouble to the oils employed for lubrication, claiming that they filled the teeth and permitted the point of the pawl to slip over. The engineer was soon convinced of



Figs. 1 to 6.

his mistake when the point of the pawl was ground down on an emery wheel, making it sharp, like its original form, and permitting it to sink into the teeth below and get a positive grip. In case the point was not long enough to permit grinding down, a new tip could be placed in the manner shown in Fig. 6, at *I*.

Old Pumps.—When pumps are so badly worn that they cannot be kept together without blocks of wood over and under them, or having them tied together with ropes, then the remedy I would apply is to replace them with something better.

Cheap Oils.—The mistake of using inferior oils for lubrication is frequently made. In one place they were using an oil in which shea butter was mixed instead of palm oil. This fat has at ordinary temperatures the consistency of hogs' lard, but at about 120° F. it melts into a pale yellow, a delicate white or a yellowish-white colored oil. The butter is produced from the kernels by first bruising, then boiling them in water. A dirty, yellowish white fat is collected from the top of the boiling mass, and this from filtration may be rendered almost colorless. On cooling it becomes a sticky solid butter. An analysis gives the following:

A variety of stearine, 70; olein, 29; gutta shea, 0.5.

The Bay State Gas Situation.

By R. W. P.

For the benefit of those of your readers who are either financially or otherwise interested in the situation named in the heading, the following attempt at an explanation of its much muddled condition is given. The word "attempt" is used advisedly, as some of the transactions are so obscure that it would be impossible to find out the exact situation without devoting more time and expense to the enquiry than it warrants.

Without going through the intermediate steps leading to the present condition, it may be succinctly stated that a large majority of the original capital stocks of the Boston Gas Company, the South Boston Gas Company, the Roxbury Gas Company and the Bay State Gas Company, of Massachusetts, is owned by the Bay State Gas Company of Delaware, and was pawned by its assignor, the Bay State Gas Company, of New Jersey, to the Mercantile Trust Company of New York, acting simply as agents, to secure a loan of 12 million dollars, this loan being represented by $9,000,000 of the Boston United Gas first, 5 per cent. bonds, and $3,000,000 of second, 5 per cent. bonds of the same name. The equities in these stocks are now owned by the Bay State Gas Company of Delaware.

The total amounts of the stocks and assets and rates of dividend of the 4 Massachusetts Companies, as shown by the last report of the Board of Gas and Electric Light Commissioners, are as follows:

	Dividend.	Stock.	Assets.
Boston	10 per cent.,	$2,500,000	$7,660,932
Bay State	12 "	2,000,000	2,655,246
Roxbury	10 "	600,000	1,193,014
South Boston	7½ "	440,000	660,339
		$5,540,000	$12,169,531

The total amount of the dividends is $583,000. The four Companies owe on notes an aggregate amount of $401,600, and other indebtedness of $856,070, showing a balance to profit and loss, or surplus, of $5,371,859.

The surplus of the Boston Company increased, from 1889 to 1890, from $135,000 to $4,317,000, and the total surplus of all the four Companies increased in the same time from $698,000 to $5,002,000.

These great increases give rise to a suspicion that a very superior system of bookkeeping was employed in making up the various accounts. These figures are not absolutely endorsed by the Gas Commissioners any further than they are able to check and verify them.

The capital stock of the Bay State Gas Company, of Massachusetts, was originally $500,000, but, in 1893, the Legislature passed an act annulling the charter of the Company unless it caused to be cancelled a certain note given by the Company for $4,500,000, and held by the Mercantile Trust Company of New York.

This the Bay State Company did, and in consideration of its so doing was permitted to increase its capital stock to $2,000,000, and the increase of $1,500,000 was handed over to the Mercantile Trust Company.

An enquiry of the Trust Company failed to elicit any reply as to whether this note or the $1,500,000 stock was held by it in trust for the Boston United Gas bondholder or otherwise. In reply to a further enquiry by a bondholder as to the exact amounts of stocks or other securities held by it in trust to secure the Boston United Gas bonds, the Trust Company, without absolutely refusing to give the information, referred the writer to the Bay State Gas Company of Delaware.

In 1891, 2 and 3 $1,247,851 was paid out for interest by the Bay State Gas Company of Massachusetts, most of which went for interest on the $4,500,000 note. The interest on the note varied, and was always at the same rate as the dividend on the stock—one-tenth of the net profits going to the stockholders and nine-tenths to the note. The rate paid was usually 10 per cent.

The question of usury was probably anticipated and provided for in some way in drawing the note.

Since this note was cancelled, the dividends of the 4 Massachusetts Companies have never amounted to enough to pay the interest on the $12,000,000 Boston United Gas bonds and the requirements of the sink-

ing fund, and the deficiency has always been made good by the Bay State Gas Company of Delaware, which it obligated itself to do.

Of the $12,000,000 of Boston bonds, the proceeds of $2,000,000 have been expended on the various plants of the 4 Massachusetts Companies, but as these bonds were not issued in Massachusetts, it is not known what was realized on them; but probably not more than 87½ per cent., or $1,750,000. This amount forms part of the increase in surplus before referred to.

The 4 Companies show an aggregate decrease in their surplus of $22,765 in their last statements for the fiscal year ending June, 1898. It would be of interest to know the exact amounts of the stocks of the 4 Companies which are held by outside interests and do not form a part of the security for the Boston bonds. The Trustees could, of course, be compelled to disclose this, although they are apparently unwilling to do so. Mr. Addicks, in a statement made at the recent meeting of the stockholders of the Bay State Gas Company of Dela ware (published in the JOURNAL of June 26, 1899) referred to some small amounts held by himself and other friendly (?) interests, but did not indicate what proportion he considers a small amount. Whatever it may be, it reduces the amount of the dividend which is available for payment of the interest on the Boston United Gas first and second 5 per cent. bonds.

The authorized issue of these bonds is $12,000,000 of firsts, and $4,000,000 of seconds. Of the first, $7,000,000 were originally issued, and subsequently $2,000,000 for improvements on the works and plant of the 4 Companies, as before mentioned. The remaining $3,000,000 was retained for the purchase of other gas works, and is still unissued, as the "other gas works" have not been purchased. Of the seconds, $3,000,000 have been issued and are now outstanding.

A sinking fund of 1 per cent. a year (which, however, it was agreed should not go into operation for several years) was provided for the retirement of the first bonds, which fund has now cancelled $625,000, making the amount of first bonds outstanding $8,375,000, or a total of first and second bonds outstanding of $11,375,000. No sinking fund was provided for the second bonds.

The interest on the above outstanding bonds calls for a yearly payment of $568,750, and the requirements of the sinking fund a further payment of $90,000 (if bonds were purchased at par) making a total of $658,750.

The dividends paid by the 4 Companies last year amounted to $583,000, from which should be deducted their loss of surplus, $22,765, to arrive at net earnings, and also the dividends on the "small" amount of stock held by Mr. Addicks and his friends, and trust expenses, say $14,235, or a total of say $37,000, making net earnings available for bond interest and sinking fund of $545,000, and showing a deficit of about $114,000.

The amount available for interest on second bonds is, therefore, only about $36,000, or 1¼ per cent. At the close of the fight between the 4 Companies and the Brookline Gas Company, in 1896, it was agreed that the Boston Gas Company should guarantee the Brookline Company an amovnt sufficient to enable it to pay all its fixed charges and 10 per cent. on its $2,000,000 of stock, by purchase of a sufficient quantity of gas from the Brookline Company at $1 per 1,000 cubic feet.

It is generally understood that this agreement would not stand the test of a suit, but if it were abrogated it would immediately precipitate a renewal of the old war.

In the meantime the earnings of the Boston Gas Company are being diverted from paying the interest on the Boston United Gas first and second bonds, and are being applied to maintaining the 10 per cent. dividend on the Brookline stock, and partly occasioning the deficit as above shown.

Nothing is said in the last report of the Commissioners about any gas being sold by the Brookline Company to other companies, and as that Company sold 35 million feet more gas in the last year of the fight (1895–6) than it did last year, the operation of the agreement between the Boston Company and the Brookline Company does not appear.

The first reference by the Commissioners to this agreement is contained in their report of January, 1898, where in the Brookline profit and loss account appears a credit under the head of "Boston Gas Light Company, $61,910," and in the 1899 report, under the same head, $52,298.

No debits of like amounts are to be found in the statements of the 4 Companies and no other reference is made to these payments in the body of the reports.

It seems probable that the terms of the agreement were changed to a cash payment, with the consent of the Commissioners. The Boston Gas Company seems to have figured in this and other transactions as a very desirable old cow, with an almost unlimited milking capacity. We also learn, from the Commissioners' Report of 1893, that, in 1890–1, this Company was compelled to buy its coal from the Bay State Gas Company, of Delaware, at an extra cost above the market price of $33,700, as estimated by the Commissioners, and that during the same year the tar from the North End works of the Boston Gas Company was sold to the Bay State Company, of Massachusetts, at a profit to the latter Company of $8,000, and that, in 1889 and 1890, it (the Boston Company) had paid in rentals for the use of a portion of the 15¾ miles of mains of the Bay State Company of Massachusetts, $200,000; the whole cost of such mains being estimated by the Commissioners at $208,500, which cost appears to be very liberal, even for that time.

The same report shows that, in 1890 and 1891, the Boston Company had bought from the Bay State Company of Massachusetts nearly 1,200 million feet of gas at $1 per 1,000 feet, and that the Boston Company could have manufactured this gas itself at a cost somewhere between 53 cents and 60 cents per 1,000 feet, showing a loss to the Boston Company of over $500,000.

In 1895 the right to manufacture acetylene for Boston was "acquired;" but how much was paid for it, or upon which particular Company it was unloaded, is not known.

The Brookline Gas Company has, in addition to its $2,000,000 of stock, $1,000,000 of 5 per cent, bonds outstanding, and notes of $165,000, and a floating debt of about $1,500,000, which latter amount is naively included in its statement in the item, "Amounts due from the Company, not included above, $1,500,059."

The wording of this item is that given by the Commissioners in the form of statement required by them from the gas companies, and is only intended to cover small amounts too insignificant to be separately itemized.

The Brookline Company has repeatedly made application to the Commissioners for permission to fund this floating debt, but has always been refused, as the Company cannot show property value for it.

As no dividend was paid by the Brookline Company in the years 1895 and 1896, and only 2 per cent. in 1894, it is fair to assume that at that time little if any dividend was being earned, and as no general increase in price of gas followed the cessation of the war the conditions cannot have changed very materially as regards price of gas.

The reduction of operating expenses last year compared with an average of the three preceding years amounts to $70,000. The $50,000 or $60,000 paid by the Boston Company, added to the profits of the electrical department ($26,000), and the gas department ($273,500), just about balance the interest and dividend payments and interest on floating debt.

During the last year of the war (1895–6), though the Company paid no dividend, it showed a manufacturing profit of nearly $213,000, of which about $14,500 was from the electrical department.

The agreement between the Boston Company and the Brookline Company, being, in the opinion of experts, if not absolutely void, at least voidable, it was naturally kept more or less secret.

The first public reference to it appeared in Mr. Thos. W. Lawson's, pamphlet entitled "About Boston Gas and New England Coke," published Dec., 1897. In this publication he also says (p. 11): "The Bay State Gas Company of Delaware, can retake the possession of the Boston, South Boston, Roxbury and Bay State (of Massachusetts) Gas Companies, when it, either by purchase, redemption, operation of the sinking fund, or in *other ways* obtains or cancels the $9,000,000 Boston United gas bonds, first series."

As the Bay State Gas Company of Delaware (the assignee of the Bay State Gas Company of New Jersey which originally mortgaged the stock of the 4 Companies) did not part with the possession of the gas companies by the act of mortgaging the stock, the restoration of such possession in the way stated must depend on the provisions of the agreements of May and November, 1896, between the Boston and Brookline Gas Companies, to which Mr. Lawson refers, and which he claims to have drawn, and of which he should be able, therefore, to speak with authority.

Mr. Addicks's scheme to recover control of the 4 Boston Companies, as outlined by his remarks to the Delaware stockholders, appears to be to default on the interest on the bonds. By the terms of the mortgage, the principal and interest will then become due and payable, of which he will be notified by the trustees, when he will tender them both principal and interest and cancel the bonds.

This has been done successfully in the matter of some small mortgages, but whether it can be employed to get rid of a large amount of long bonds before they are due and to reissue them or a greater num-

ber at a lower rate of interest remains to be seen. Mr. Addicks has, however, done so much in Massachusetts that he should not despair of doing a little thing like this in New York, if he desires to, even though he is on record as stating that his company has more than sufficient money on hand to pay the interest, which payment he is bound to make by his agreement with the Mercantile Trust Company. At present market prices it would only require about $9,000,000 to pay off all first and second bonds outstanding.

In speaking of Mr. Addicks personally, we refer to him only as dictating the policy of the Bay State Company of Delaware. It is not very clear how Mr. Addicks and his Delaware Company will get any more or better control of the 4 Boston Companies by paying off the bonds than they now have.

Whatever arrangements he has made for voting the stock of the 4 Companies would, of course, not be affected by such payment, and outside of the limitations imposed by the mortgage, and restrictions imposed by himself on himself, his power is absolute in regard to the conduct of the business of the 4 companies.

It is quite probable that a new mortgage could not be issued, owing to a comparatively recent law of Massachusetts, prohibiting any future "monkeying" with the stocks of Massachusetts corporations in other States, on pain of the annullment of the charters of such corporations (Chap. 476, Acts of 1894).

The following comparisons of the operating expenses, and of the sales of gas during the years of the war with the Brookline Company and subsequently are of interest. The competition for business was at its height at the commencement of the fiscal year 1894-5, and continued to the end of the year 1895 6 when the war closed.

Operating Expenses.

Company.	1894-95.	1895-96.	1896-97.	1897-98.
Bay State	$315,955	$363,415	$382,291	$355,555
Boston	785,511	846,380	787,999	779,163
Roxbury	139,465	168,149	160,455	171,919
South Boston	63,937	81,893	82,684	89,825
Brookline	437,245	474,207	392,611	364,406
Dorchester	93,785	118,468	133,748	151,755
	$1,835,898	$2,052,512	$1,939,788	$1,912,623

Gas Sold, in Thousands of Feet.

Bay State Total	876,193	1,068,756	1,073,038	1,060,837
" " To private consumers	3,131	3,125	2,885	2,549
Boston	1,018,173	1,094,675	1,071,762	1,066,767
Roxbury	175,603	216,893	213,348	214,147
South Boston	72,968	104,220	109,745	109,228
Brookline	469,915	690,111	675,260	655,681
Dorchester	114,556	157,834	179,113	196,430
	1,854,346	2,266,858	2,252,113	2,244,802

Nearly all gas manufactured by the Bay State Company is sold to other companies. It has only about 24 private consumers. The quantity used by the latter is given in the Commissioners' Report for 1897-8. For other years it has been arrived at by multiplying the quantity used per consumer by the number of consumers.

The stock of the Dorchester Company was not deposited with the other stocks to secure the Boston United Gas bonds, but was held by Mr. Addicks and his friends.

At the close of the war this stock was turned over to the interests controlling the Brookline Company, and it is now in the possession of the New England Gas and Coke Company. Whether Mr. Addicks still has any string attached to this stock is known only to himself and the other parties interested.

Its capital stock is $519,600; in 1895, it was $400,000. It manufactures no gas, but buys all from the Bay State Gas Company. Neither the South Boston nor the Roxbury Companies manufacture their own gas. None of the Companies enumerated have any outstanding bonds, except the Brookline Company.

It is of interest to note that, while the general situation shows an increase in sales in the 4 years of about 21 per cent., the Dorchester Company has increased over 70 per cent. and the South Boston nearly 50 per cent. The decline in the total amount of gas sold during the last 3 years will no doubt be a surprise to many, but it has been generally known to those interested, that the sales, if not actually decreasing, were in *statu quo*.

The cause of this state of affairs may be looked for in the bickerings of the gas companies and the enormous increase of electric lighting, and also possibly to the bad feeling engendered by the restoration of some prices from the "cut rates" in force during the war.

The gross receipts of the Boston and Edison Electric Companies amount to 75 per cent. of the gross receipts of the 6 Companies above enumerated. The capital stock of the Bay State Gas Company of Delaware is $100,000,000, all of which has been issued. Par value of each share is $50.

The question has been asked as to where the Company got the $12,000,000 to which Mr. Addicks refers in his statement. During the past two years the Company has issued and sold $85,000,000 of the above stock. If this is the source of the $12,000,000, and there appears no other, the stock must have been sold at an average of about 14, on 100 par, which seems very high, though it has fluctuated very greatly in that time. In November, 1895, when the capital stock was increased from $5,000,000 to $15,000,000, each old holder of one share had the privilege (?) of subscribing to two shares of new stock at $10 per share of $50.

The Company also has outstanding $2,000,000 of income bonds, which, judging by the constant litigation in regard to them, appear to be perennially in default. The writer has, however, no knowledge what amount of interest, if any, is in default at the present time.

That Mr. Addicks's scheme, as outlined by him, should be carried to a successful issue is a consummation devoutly to be wished.

As in the old story in defense of fox hunting, in which it was shown that everyone liked it with the possible exception of the fox, and he had not been heard from, so in this case we know that Mr. Addicks and the State of Massachusetts would like it. The Bay State, of Delaware, stock and bondholders, the Boston United Gas first and second bondholders and the 4 Boston Gas Companies would (or should) also like it, and the New England Gas and Coke Company has not yet been heard from.

Mr. Addicks is rather premature in announcing the complete failure of the New England Gas and Coke Company in its attempts to improve on present methods of gas making.

It is true that the present prices of the stock and bonds of that Company do not reflect a very great deal of public confidence in the enterprise, but the same may be said of the figures (or rather the figure) representing the market price of the stock of the Bay State Gas Company, of Delaware. However, this is another story which has not yet been written.

The obvious conclusions to be drawn from the above statements are that the interest and sinking fund of the Boston United Gas first bonds, $509,500, consume most of the earnings of the 4 Boston Companies, say $560,000.

The interest charge is reduced $4,500 per year by the operation of the sinking fund, which latter will require nearly 100 years time to cancel the first bonds.

About $100,000 per year will have to be furnished from some outside source to pay the interest on the second bonds, unless the profits of the business are increased by this amount. The present profits of the 4 Companies average about 36 cents per 1,000 feet sold. The Brookline contract incubus costs the 4 Companies about 4 cents per 1,000 feet sold.

In going through the various transactions above described, a considerable quantity of old straw has been threshed out in some cases, which, however, seemed to be necessary in order to give a comprehensive view of the present situation.

Differential Rates as Between Consumers of Gas for Lighting and for Purposes Other Than Lighting.

By "A Gas Engineer," in *Jour. of Gas Lighting.*

The paper under the above title read at the recent Gas Institute meeting by Mr. Thomas Newbigging, naturally attracted a vigorous discuscussion. Or, perhaps, I should say that the title attracted a discussion; seeing that most of the speakers gave results from their practice in the matter, and did not touch upon the propositions laid down by Mr. Newbigging—viz., that differential rates are an injustice, and that they will injure the gas industry—or upon the assumptions by which this opinion was supported. Many of the last named are decidedly out of accord with the views which have found general acceptance in the gas industry, and as such seem to call for a few remarks. In making these, I desire to avoid a partisan spirit, or anything in the way of taking up the cudgels on behalf of the opposite point of view to that adopted in the paper, and to look at the subject in broad and independent manner as regards all the interests concerned—admitting that the gas-for-lighting consumer is entitled to fair and just treatment, but also bearing in

mind that this should extend to all classes of customers, and to the shareholders also.

Before proceeding further, I should like to congratulate Mr. Newbigging on occupying a unique position, in a general way, as a voluntary advocate on behalf of the gas-for-lighting consumer. Modern ideas of trade do not extend far beyond selling in the dearest and buying in the cheapest market, competition to the death, and so on; and they leave but little room for abstract principles of justice or fairness as between one customer and another. One need not go beyond the supply of ordinary everyday commodities to find examples of differential rates that are far in excess of the modest limits practiced in the gas industry. Not to go outside our own tracks, I need only instance the coke trade as carried on by some of our largest undertakings, and would suggest that next year Mr. Newbigging should review it from a similar standpoint. But the matter now in view is that the paper and the tone adopted by several speakers on it advocating fairness and justice towards the consumers, find no parallel in any other industry. One may go further, and claim that this feeling is, and always has been, very widely disseminated among managers and directors of gas undertakings, and thoroughly permeates the business—even including the erring 87 who are referred to, more in sorrow than in anger. A claim that the gas industry occupies a very high moral platform in the world of commerce would probably be received with public derision. But who can instance an example of a tradesman advocating even prices and even profits to all classes of customers; of a railway director who exerts himself on behalf of fixed mileage rates to all parties alike, whether for passenger or goods traffic; or of anyone who comes forward from the selling side of the counter to advocate justice for the customer who pays the tip-top price?

The term "cost price" is used in a different sense to its ordinary acceptation. The statement that some gas companies are selling gas at even less than cost is surprising, until we find by reading further that Mr. Newbigging includes maximum dividends and interest in the "cost price." On this basis we can understand how it is possible to sell at a loss and yet make a profit. Any gas company not able to pay maximum dividends is "losing money," and may go on for years selling "at a loss" and yet earning 8 or 9 per cent. profit. To make the parallel good, we must assume that the old lady who bought eggs at 6d. per dozen received a fair trade discount—say, 25 per cent.—on the price. She would then be in the same position as a gas company who do not quite earn the full dividend allowed by their Act of Parliament. She would not have the full trade profit, but still might make a fairly decent living by selling the eggs at 13 for 6d. Again, suppose a commission agent is accustomed to make 5 per cent. on certain transactions. On some of these he finds himself unable to earn more than 4 per cent. According to Mr. Newbigging, he is losing 1 per cent., and "exemplifying his ability to live by his losses." In speaking of "cost price," it is usually understood that all appropriations for profit are excluded, and the actual expenditure for materials and labor alone considered. It is the total on the expenditure side of the revenue account, *exclusive* of the balance carried to profit and loss. This balance usually amounts to 25 or 30 per cent. of the total receipts; and in the case of a gas company selling gas at 3s. per 1,000 cubic feet, it would amount to 9d. or more per 1,000 cubic feet of gas. Let us suppose that 2s. 3d. represents the cost price as popularly understood, and 9d. the sum required for maximum dividends and interest. Mr. Newbigging claims that 3s. is the cost price, and that a special offer of 2s. 9d. or 2s. 6d. would be a case of selling 12 cubic feet at the prime cost of 13. But the view taken by those who advocate differential rates is that the prime cost is 2s. 3d., and that a special offer may induce a class of business that could not be otherwise obtained, the profits on which would not be less than those on the ordinary 3s. rate. This point will be followed out in more detail as I proceed; merely remarking for the present that, while Mr. Newbigging contends that the sale of gas at 2s. 9d. or 2s. 6d. must mean a loss or deficit that must be made up by picking the pockets of those who pay 3s., it is quite possible that the 2s. 6d. or 2s. 9d. gas may be furnished under circumstances that still leave the 9d. available for dividend—in other words, that the 3d. or 6d. is met by an economy in working expenses, and does not touch the 3s. consumer at all.

We are also given to understand that in the United Kingdom there are 57 boards of gas directors and 30 gas committees who are either not so well informed as they should be as to the proper methods of conducting their business, or have been reduced by the immoral influences of the differential rate into intentionally favoring their friends at the expense of the remainder of the customers, and therefore stand in need of a periodical reminder that "honesty is the best policy"—a reminder, by the way, that never did any harm. No doubt there are "guinea pigs" and self-servers among gas directors; but I venture to think they are the exception, and that the majority of the 87 are endeavoring to conduct their business efficiently, and are as anxious to deal fairly with their customers as the average "one price" man. Mr. Newbigging to some extent gives his case away in granting that circumstances arise which justify differential rates. He admits the justice of a discount to large consumers; he thinks that the public lighting authorities are entitled to some consideration on account of their 3,800 hours per annum schedule; and on a previous occasion he has advocated a lower price to a customer close to the gas works, as compared with one in an outlying district, when the works belong to a local authority. But he regards differentiation according to the purpose for which gas is to be used as absurd and wrong. Yet many of the arguments in favor of the large consumer, the long-period consumer, or the central consumer are applicable to the differential price question as regards various purposes for which gas is used.

The first article in the one-price-for-all-purposes creed is the assumption that the expenditure varies *pro rata* per 1,000 cubic feet of gas manufactured, and that if the production doubles, the expenditure also doubles. But it is well known that it varies according to many factors, and not one; and that some of the items are entirely independent of the quantity of gas sold. Certain expenses have to be met if no business is done. Others vary per consumer, per meter, or per mile of main, or according to the profits. So the exact cost of each consumer is not a fixed quantity, but a complicated variable, depending not on the simple proportion of number of consumers to the total expenditure, or the personal consumption to the total consumption, but on the quantity used, the number of hours during which it is used, the maximum rate of consumption in regard to the general maximum rate, the distance from the works, and many other variables. These conditions fluctuate so much that probably no two consumers are alike, in the matter of cost price; and therefore the large consumer helps to pay for the small, and the all-the year-round for the winter customer.

The consumers close to the works, and in the center of the district, help to pay interest on the spider legs that stretch out, perhaps 3 or 4 miles, for the supply of outlying districts. Not only is each consumer a variable quantity in the matter of cost as compared to others, but he is a changing variable. Even if his own demand is regular, the cost of serving him is influenced by the action of others. A customer may take 100,000 cubic feet of gas per annum regularly, but the cost of serving him may be affected by increases or decreases in the general or total consumption. If it falls 20 per cent., the cost of serving him will be increased; and if it rises 20 per cent., the cost will be diminished. Alterations in the nature of the purposes for which gas is used will also have their effect; and I leave out of consideration the result of fluctuation in cost of coals or residuals. If a large increase takes place in the day or summer consumption, the stationary customer can be served at a cheaper rate. So no one consumer can claim that he contributes an aliquot share to the balance available for profit, and is therefore entitled to pay no more or no less than the average price. The one price system is simply a well intentioned, but crude, attempt to secure justice for all. It is, however, not likely to approximate closer to that desirable, but unattainable, result than a well-arranged differential system based on the actual circumstances of the undertaking. And it is impossible to lay out a particular pattern, either on one price or on differential lines, that is applicable to any and every undertaking. Each must stand on its own bottom; and at the best, whatever the method of charging adopted, one can only proceed on broad general principles, dealing with the customers as including a few classes only, and not as individuals.

Some of the arguments adopted in the paper are simply those of the party who is out of the swim or on the wrong side of the hedge. This class of individual, like the poor, is always with us, and that without regard to the justice or otherwise of the system of charging. If we decide to serve all alike, or to suppose that we are doing so, by adopting one fixed price with no abatement or no discount, there is the injured individual who always pays down on the nail, while his neighbor takes three months' or six months' credit. The first has to pay a share of the cost of getting the money out of the second. Or another who, like the village blacksmith, is in evidence "week in week out from morn till night," and yet is thought of no more importance than the customer who is a sort of gas-consuming comet, coming into touch with the rental book for a few weeks only in midwinter, and out of sight on an eccentric orbit during the remainder of the year.

There is also the large customer close to the works, who grumbles that he has to help pay for the mains and the leakage all over the dis-

trict. The act of trying to meet one malcontent clears the way for another. If we introduce a scale of discounts according to quantity consumed—say, 5 per cent. for accounts of 100,000 cubic feet or over—we open the door for the unfortunate gentleman whose meter has "stopped short" at 99,000, and who does not forget to add many significant nods and shakes of the head in mentioning the fact, or the self-dubbed friend of the working man who wants to know why the luxurious mansion of the millionaire should be lighted at a cheaper rate than the cottage of the poor but respectable artizan. A discount of 2½ per cent. for cash in 30 days, brings with it the difficulty of dealing with the doubtful party who, having lost the prospect of the net, elects to take long credit for the gross, and is probably next heard of through the medium of a sheet of blue foolscap embellished with the royal coat of arms. Then there is the cheque for the net amount which reaches the office by post about the 20th of August (the last day for discounts being the 30th of July), and which the drawer wrote out and "intended" to leave at the office before going for his holiday, but left it in his pocket by mistake. If we make a deduction to users of stoves and engines, then the ground is cleared for the case of the gas-for-lighting customer, as so ably and forcibly put by Mr. Newbigging. Many who have adopted the differential price in the hope of "satisfying" their customers have been disappointed, and may have wished that they had kept to the old rule. The one price is certainly simpler and less troublesome than any system of discounts or abatements; but that does not touch upon the proposition laid down in the paper.

(To be Continued.)

Electric Lighting versus Gas.

[A paper read by Mr. John Martin at the last meeting of the Pacific Coast Electric Transmission Association.]

When I became interested in electric lighting some four years ago, due to an investment in a water transmission plant furnishing light and power, the subject of proper rates for illumination became a matter of investigation for me, which I have continued up to the present time. This investigation brought me in contact with gentlemen operating both gas and electric plants, whose opinions were so greatly at variance that it became almost compulsory to experiment in order to obtain anything definite as a proper basis for the service rendered. The conclusions which I have reached are based upon personal experience, which may be of some interest to others, at least to the extent of bringing out a discussion from practical sources which may lead to a better understanding of this great problem that is ever present to managers of lighting plants.

Unbounded enthusiasm and blind prejudice were so strongly imbedded in the minds of many managers of both electric and gas plants, that very little was accomplished in the matter of a fair and straight adjudication of rates and service until they came in contact with the opposing method of illumination, usually brought about by consolidation. This enabled the opponents to get a proper appreciation of the merits and shortcomings of the previously opposing methods of artificial illumination.

When electric lighting was first introduced, it was the custom for the promoters to load the plant with excessive first cost and comparatively very inefficient apparatus. The results then obtained caused the gas men to become confident that electric competition would not be serious. So true was this that when the Welsbach burner was first presented to them they spurned it as an evil to be avoided, for by its use the consumer's bill would be decreased.

After some years of evolution the electric installation has been greatly perfected, its cost materially reduced and its efficiency very largely increased. The gas men in self defence took up the active use of the Welsbach burner, which to-day is their greatest help in competing with incandescent electric lighting.

The usual methods previously in use in competition were such that when a company would establish very low rates for one kind of artificial illumination, the manager of the opposing company would either decide that the opponent would surely go into insolvency at a moment's notice or resort to the usual method of making a reduction for his illuminant. This was usually persisted in by both companies until each lost money in the sale of current or gas for illuminating purposes. Both sides became content with a false idea that they were pursuing the proper course because they saw nothing but failure ahead for their competitor, whereas at the same time they failed to appreciate their own unfortunate losing situation. The many losses sustained in this vicious method of competition usually resulted in a consolidation of interests, and after a thorough knowledge of both methods of illumination, these companies have since become profitable without excessive rates being charged to the consumer.

When competition presents itself at this day, the wise manager makes it a business to study closely the full strength of his adversary, and if a vicious competition is unavoidable, he considers it his duty to arrange his rates to give at least a small profit to his company, if by doing so he can compel his adversary to suffer loss. If, on the other hand, he finds that competitive rates would cause his company a loss and at the same time were high enough to enable the opposition to make a profit, he then considers it his duty to make the first advance looking toward a consolidation or a working arrangement with his adversary whereby both can live.

In determining the question of rates, the following fact is usually lost sight of in assuming the ability of your adversary to maintain low rates, namely: *Low rates are always conducive to largely increased consumption.* Larger output insures reduced cost of production, so that when a gas plant cannot pay with its present consumption at less than $3 per 1,000, yet with a quadrupled consumption it can pay at $2 per 1,000; or an electric plant hardly paying expenses at 20 cents per 1,000 watts, may under similar conditions of increased output pay handsomely at 12 cents per 1,000 watts.

Several months ago I addressed communications and questions to many managers East and West, asking for information as to rates, character of installation, competition and success of competing companies, from which I will quote (without specific reference), and at this juncture desire to express my thanks to all for their kindness and consideration in giving the information asked for and their ideas of policy.

As this paper is being submitted mainly for the consideration of the proponents of electric lighting, I desire to present several opinions as expressed in answer to the following query:

In your judgment what plan is best to adopt to successfully cope with gas competition, and on what prices for gas is your plan based?

Among the answers I received the following:

From a large New York plant:

Gas, 95 cents per 1,000. Incandescent lights, 20 cents to 10 cents per kilowatt hour.

In my judgment, to compete with the Welsbach we should avoid too active a campaign, as it would tend to excite the gas interests to great activity. The Welsbach's popularity is soon lost owing to decreasing candle power, disagreeable light and short life of mantles.

From a New Jersey plant:

Gas, $1.50 per 1,000. Electric light, 13½ cents per kilowatt hour.

Low rates and good service, with enough business enterprise to call the attention of the public to the decided advantages of electricity as an illuminant, will easily meet gas competition. If all houses in our territory were wired, we would have little difficulty in securing most of them as customers, because wiring old houses stands in the way of our getting many customers who are otherwise anxious for the light.

From a Massachusetts plant:

Gas, $1.25 per 1,000. Incandescent lights, 23 cents to 12½ cents per kilowatt hour.

We compete quite successfully with gas at prices named, by giving good service and the conveniences of electric light over that of gas. Also the fact of electricity being more healthy.

And a few selections from Pacific Coast plants:

The best plan is to consolidate; if not, fight fire with fire by the installation of a modern gas plant as an adjunct.

With small consumers, namely, residences, suggest flat rate based on a specified number of lights burned at one time with an overload meter or overload vibrator for excess.

Good service and low rates. Rates to be about equal to gas rates, candle power for candle power. There are large separate fields for both gas and electricity.

From these answers it is fair to assume that the average electric lighting company is on a progressive and profitable basis, but it should not be inferred that gas plants are not. The reduction in prices of gas for fuel has opened a very large and profitable field for the gas companies heretofore unoccupied by them, which has compensated partially, if not wholly, for the loss of sales for illumination. Such being the case, the increased production of gas for heating purposes has prompted the gas companies to lower their rates for illumination, generally without specific losses. It is therefore unwise for managers of electric plants to believe that gas plants are on the decline and in a condition bordering on decay. While it may be, and is probably true, that enormous profits are a thing of the past, yet with good active management a gas plant may continue in business without serious loss, in competition with an

electric plant if properly managed and every legitimate economy adopted. From this I do not desire the gas men to establish false hopes in the theory that if they can at least make a small profit now, they may eventually hope to make a larger profit in the future.

The improvements in the electric service are so marked and rapid that there is little hope left for the gas plant as a very profitable competitive illuminant, unless working arrangements are make with the opposing company.

I will now consider from a theoretical standpoint the two methods of artificial illumination.

The candle power of illuminating gas that is furnished throughout the United States ranges from 16 to 20-candle power, and I have assumed 18-candle power as the value of the average gas so furnished, burning 5 feet per hour in an open burner.

The consumption of a 16-candle power incandescent lamp ranges from 50 watts to 70 watts per lamp, and I have assumed 60 watts as an average consumption for a 16-candle power lamp. The average consumption of gas through a 4-foot tip is approximately 6 feet per burner per hour. The consumption of gas through a Welsbach burner averages 3 feet per hour per burner. The average candle power of a Welsbach burner is 42 candles.

With the use of an open tip burner 1,000 feet of gas consumed will produce 3,600-candle hours. In the use of a Welsbach, 1,000 feet of gas will burn 333⅓ hours, producing 14,000-candle hours.

In order to produce a theoretical equivalent of illumination, the 16-candle power incandescent lamp will have to burn 225 hours to equal the consumption of 1,000 cubic feet of gas through a common tip burner, which aggegates 13½-kilowatt hours, and in theoretical competition with the Welsbach burner it would have to burn 875 hours, consuming 52½-kilowatt hours of electric current.

On this theoretical basis, with gas at $1.50 per thousand, using a common tip burner, electric current should be sold at 11 1 9 cents per kilowatt hour. If gas is $2 per thousand, at 14 8 10 cents per kilowatt hour. Gas at $2.50 per thousand, 18 2-10 cents per kilowatt hour, and gas at $3 per thousand, 22 2-9 cents per kilowatt hour.

The theoretical rate in competition with the Welsbach with gas at $1.50 per thousand, current should be sold at a little less than 3 cents per kilowatt hour, and a proportionate increase for the higher prices of gas.

From the above it is obvious that the open burner cannot successfully compete on the Pacific Coast with the incandescent lamp, and it may be assumed that the Welsbach burner holds a mortgage on efficient illumination.

While the above figures are based entirely on theoretical equivalents, there are practical conditions which affect the proportions to such an extent as to introduce a personal equation. These conditions can be summed up as follows:

Among the objections to Welsbach lighting, as determined by the consumer, are, first, decreasing candle power; second, disagreeableness of the light changing from incandescent white to a yellowish-green; third, brittleness of the mantles; fourth, difficulty in lighting; fifth, limited sphere for decorative effect; sixth, vitiation of the atmosphere. These objections permit the sale of current for incandescent lighting at higher prices because of a large number of consumers who are willing to pay a little more for illumination when the above objections are eliminated, as is the case with the use of the incandescent lamp.

The personal equation above named also makes the use of Welsbachs permissible, for there are a number of consumers who are willing to submit to the objectionable features enumerated and thereby effect a financial economy in illumination.

The conditions existing on the Pacific Coast, where a large amount of electric illumination is produced by the use of water power, and current is sold at flat rates, the question of cost of illumination in competition with Welsbachs is very largely removed. The rates charged in California for residence purposes will average 25 cents per 16 candle power lamp per month, 24 hours service, and 80 cents per light per month for business purposes.

The Eastern managers as a rule, and some of our Western managers, believe firmly in the sale of current by meter measurement exclusively, while California managers have established flat rates almost entirely. It is a fact that the only satisfactory basis for selling current produced with fuel is on meter basis, and many managers also argue that all illumination should be so charged.

From the standpoint of a manager of a water power installation, I must take issue with the latter contention. When current is produced by a water power plant (and by this I mean a plant having ample water power for its installation through the entire twelve months of the year), the establishment of the flat rates has proven satisfactory in many plants in California. It has the one advantage of eliminating disputed accounts. Each patron knows in advance what his light bill will be, which is alike satisfactory to business men and housewives. The restriction in extravagant use of current with flat rates is the life of the lamp, the renewals for which the customer pays.

By making very low rates per lamp installed, the home is wired more liberally, and my experience demonstrates that the low rates for residence use have increased the consumption per lamp very materially. This means better illumination for more hours per day than when sold by meter measurement. The old habit of turning off the light to effect economy has vanished, and with it comes the fortunate disease of good, liberal illumination. This disease becomes infectious until finally the entire town is afflicted. This affliction is indeed a blessing; the homes are more cheerful and pleasant, and at the same time the feeling of extravagance is not experienced.

Admitting that the only restraint in consumption is the cost of renewals, the question arises as to what compensation does the electric company obtain for its service. From personal experience I find that with an average of 500 consumers at residence rates, the amount of current furnished equals 38 per cent. of the total capacity of the lamps installed. Assuming an average residence rate of 25 cents per 16-candle power lamp, we obtain an average revenue approximating 66 cents per lamp current per month, or about $7 per H.P. per month This leaves the current available for day service power, which can be disposed of on a profitable basis. It is true that some plants are selling power in large units at from $5 to $10 per H.P. per month for twenty-four hour service. From this it is evident that illumination at these low rates is profitable even after paying the additional interest on the investment, and the depreciation, cost of maintenance, operation and repairs of the distribution system. In business houses the rates are necessarily higher, because all lights are used at the time of peak load. This peak load is the determining factor of the capacity of the plant. The development of the day service for power at some plants produces an average twenty-four hour load factor ranging from 70 per cent. to 80 per cent. of the peak load.

Water Power Electrical Plants in the United States.

[A paper read by Mr. B. C. Washington, Jr., before the Electrical Section, Franklin Institute.]

In presenting to you a paper on "Water Power Electrical Plants in the United States," it is my purpose to show you the great importance of the development of this great branch of our natural resources, and to describe and illustrate a few of the more important plants, and give you the benefit of some statistics gathered by personal correspondence with those directly in charge of over 300 plants. The illustrations cover almost the entire field, and show the perfection attained by the unparalleled genius of American minds in the production of suitable machinery to meet all the different requirements imposed, no matter what are the conditions.

For many centuries man has patiently and earnestly sought to control the vast powers of nature, so that they shall do his bidding. Human genius has triumphed, and now on the eve of the 20th century an enlightened world gazes in wonder and admiration while Americans harness the power of their greatest rivers, convert this power into electricity and transmit it with commercial success to distant mining or manufacturing centers.

The application of water as a power for driving mechanical devices is supposed to have been attempted in Rome, about the time of Augustus, 63 B.C. to A.D. 14. During the succeeding centuries various machines have been originated for the utilization of water power, and recent years have witnessed a most rapid and wonderful progress in their development. The old power wasting water wheels of various types have been superseded by turbines for ordinary heads of water, and wheels of the Pelton and Impulse types for extraordinary heads.

The first transmission of electrical power for industrial purposes was accomplished in 1878, at Sermaize, a short distance from Paris, France. The dynamos in this instance were driven by steam engines. Shortly after this demonstration of the practicability of the transmission of electricity, followed the application of water wheels for driving dynamos.

In the United States there are now nearly 500 electric plants operated by water power, or water power and steam combined. Notwithstanding this, there are many hundreds of fine water powers totally undeveloped, or only partially developed, which would yield handsome returns on the cost of improving them and utilizing their power for the

generation of electricity. Some are more favorably situated than others, but nearly all of them of any commercial importance can be developed.

The immense advantages of electrical development are its cheapness, the flexibility and divisibility of the power, and the ease with which it can be transmitted from the point of generation to the point of utilization.

As a power producer the stream must be reasonably steady in the quantity of its discharge. This can be readily determined by pursuing the accurate methods employed in stream measurements by the government hydrographers.

Having ascertained the fall, and the quantity of discharge, the amount of power that is available is readily determined. The next problem is the disposition to be made of the power when it is developed. This is often known in advance, but in some cases the power owners are confronted with many difficulties. The location of the power may not be suitable for a manufacturing site, and should it be desirable to transmit the power to manufacturing centers, existing power and light companies may own franchises which give them exclusive control of the territory. It is not always an easy matter to induce manufacturers owning expensive steam plants to discard them and substitute electricity, although they know it to be cheaper, more reliable, cleaner and generally safer than steam.

The problem of water-power development is, as a matter of course, one of dollars and cents, and the main question is, will the income be sufficient to pay a reasonable per cent. on the investment, over and above general and operating expenses, taxes, maintenance and repairs and depreciation? This question is referred properly to the engineers in charge of the prospective depelopment. The development naturally divides itself between the expert in hydraulics and the expert in electricity. To these experts it remains to solve all the varied and sometimes exceedingly difficult problems that are presented. The machinery for these plants must be constructed to suit the conditions imposed, and the conditions are the unknown quantities which enter the equations and are only solved by experienced engineers. The up-to date manufacturers of water wheels and electrical apparatus employ the best of engineering talent, and this talent is at the disposal of those contemplating the construction of water power electric plants. Upon the engineers devolve the selection of the site for the dam and power house, and the preparation of plans and specifications for their building and equipment. The kind of dam and its location depend largely on the character of the stream, the shape and geological structure of its sides and bottom, and also the topographic features above and below the prospective site. Of course, dams are constructed to withstand extraordinary freshets and injury from ice and floating *débris* of all kinds, and of a height that will not cause disastrous results to surrounding property from overflow or backwater. Proper protection is afforded canals, waterways and penstocks leading to the power house, and ample provision made to keep sand and other detritus from entering the water wheels. Local conditions are also important factors in the selection of the site for the power house. When practicable, it is located as near as possible to the source of power, so that the expense for canals, flumes and penstocks will be reduced to a minimum.

The plan of the power house depends largely upon the style of water wheel used and the method adopted for delivering the water to the wheels and carrying away the discharge water, the connections between the water wheels and generators, and whether the plant has additional or reserve steam power. The building and foundations for wheels and generators must meet every requirement of strength and solidity. The entire construction must also be fireproof. No power house is complete without a travelling crane.

Recent construction shows a very commendable desire on the part of engineers to standardize the building plans and machinery as far as practicable. The locations of switchboards, transformers and outgoing wires are matters of detail for the engineers to decide. Currents of high voltage require extraordinary care in the placing and insulation of transmission wires, and the best methods in use will be shown later.

There are at present two styles of water wheels in general use in the United States for dynamo driving, viz.: Turbines and impulse wheels. As a rule, the use of turbines of the vertical and the horizontal style is confined to powers of ordinary head, where the water is plentiful. The impulse wheels are a necessity under opposite conditions. There are, perhaps, some exceptions to this statement, but I do not think them sufficiently numerous nor important to be cited at this time.

Both styles of water wheels require the use of water wheel governors, and this is especially true of plants where there is a variable load on the generators.

There are many different devices on the market for governing water wheels. Reports from the plants show that the field is almost entirely covered by three governors, viz., the Replogle, the Lombard and the Geissler. They give remarkably close government under all working conditions, and guard against excessive speed or racing in case of the whole load going suddenly off, as in the case of circuits opening. Only last year you had an able paper read to you on the government of water wheels, so that there remains little for me to say in connection with this subject, except that Mr. Replogle has perfected and brought out a new governor. It is well known that the voltage drops at the receiving station as the load increases on the line of long distance transmission plants. This latest governor of Replogle's can be so adjusted as to automatically increase the speed of water wheels as the load increases, thereby holding the voltage constant at the distant end of the line. In making this advantage possible, he has not destroyed the principle that holds all the gates at several wheels to the same opening, where a number of units are running in parallel.

The kind of generators used, of course, depends largely on the length of the transmission line and the work required. For all long distance transmission alternating current generators are used. The voltage of the current generated is raised by transformers and carried at high voltage to the receiving station, and there stepped down by lowering transformers and utilized for light and power purposes.

The pole lines follow roads when practicable, and when run across country the timber is cleared from both sides of the line, so that uprooted trees and limbs broken by storms will fall clear of the line. The poles and cross arms are of selected timber. The poles are firmly planted and securely braced at curves. Special high voltage insulators are used. The transmission wires are bare copper, the high voltage permitting the economical use of light wires. The wires are spiralled to prevent induction if telegraph or telephone wires are strung on the same poles.

With this brief general outline of some of the features kindred to water power transmission plants, I will briefly describe some of the large transmission plants in successful operation in the United States, and attempt, figuratively speaking, to take you through them by means of illustrating the machinery they have in use at the same time it is described. You will kindly bear in mind that some of the ground has been covered by descriptive articles published in technical papers. Nevertheless, it is necessary to make use of some of this material in order to bring out all of the different types of machinery used, the various methods employed in connecting water wheels and dynamos, and the applications of the power for various mechanical purposes.

The Folsom Sacramento Electric Transmission Plant.—For data relative to the Folsom-Sacramento electric power transmission I am largely indebted to Mr. George P. Low and the Sacramento Electric, Gas and Railway Company.

The water power of the American River is utilized for driving the generators. The various forks of this river rise in the Sierra Nevada Mountains near Lake Tahoe. The water supply of the river presents some peculiar features not found elsewhere, in that the flow of water is derived from new sources at all seasons of the year. In the late spring and summer months the melting snows in the mountains "bridge" over the "dry season," and in the fall, just as this source of supply is on the wane, the rainy season sets in. The foundation of the dam was begun in 1886 by the Natoma Water and Mining Company, and on this foundation, in 1888, the transmission company began the work of completing the dam. The river is confined for many miles by high granite bluffs, and where the dam is erected they form a natural point for the building of such a structure.

The dam contains 30,000 cubic yards of masonry and the headworks about 15,000 cubic yards. The storage capacity of the dam is about 13,000,000 cubic yards of water. The shutter is a trussed timber platform, which rests in a masonry recess running longitudinally along the top of the center of the dam. When lowered it is secure from damage by floating *debris*. The shutter is operated by five hydraulic rams.

The sand gates, each covering an opening 5 by 6 feet through the wing dam, are located at the end of the dam to prevent sand or gravel from passing into the canal and causing injury to the water wheels. The bottom of each gate is 8 feet below the bottom of the canal, and a short distance further down the stream a wall 8 feet high is built directly across the canal. The inlets to three of the gates are tunnel-like openings covering the width of the canal. As the openings are 8 feet below the bottom level of the canal, the water has sufficient flow to remove and discharge heavy substances into the river below. The dam and headworks are built of granite taken from the cliffs on each side of the river. The west bank of the canal is built of granite part of the distance and of earth the remaining distance. The headgates are operated by hydraulic rams.

Two thousand feet down the canal a drop of 7.33 feet occurs. At this point is located the State power house. This building extends across the canal. The building is 160 feet long, 60 feet wide and 60 feet high, and is built of heavy granite masonry. Six special 87-inch Leffel turbine water wheels with vertical shafts, geared to bevel pinions to a horizontal shaft overhead, deliver power for electrical and other purposes. About 800-horse power is now utilized. Without waste the water flows on in a canal built by the Folsom Water Power Company. At the terminal of the canal is a forebay 150 feet long, 100 feet wide and 12 to 15 feet deep, constructed with ample provision for cleaning out silt and preventing it from reaching the turbines. The hydraulic machinery was all made and furnished by the S. Morgan Smith Company, of York, Pa., and consists of four pairs of 30-inch McCormick horizontal turbines of 1,260-horse power each. The wheels run under a head of 55 feet at 300 revolutions per minute, and are directly connected by couplings to the armature shafts of the generators. The inlet pipes are 8 feet in diameter, and made of ¼-inch steel. Double draft tubes are provided for each set of wheels. Between the four large wheels is the special wheel for driving the exciters. The wheels are made of phosphor bronze, and each pair is furnished with steel flywheels 10 feet in diameter, weighing 10,000 pounds. To each of these four double turbines is directly coupled a 750 kilowatt 3 phase generator built by the General Electric Company. These were the largest constructed up to that time (1888). They are 8 feet 8½ inches high, cover a floor area of 11 feet by 8 feet 8 inches, and weigh nearly 29 tons each. The generators have 24 poles, and deliver 3 phase current at 60 cycles per second at 800 volts. There are two four pole 500 volt exciters, of 30 kilowatts capacity each, either of which can be used to excite all four generators. The generators are carefully insulated from, and securely bolted to, solid masonry.

The current is led through a simple switching board to the bank of step-up transformers on the upper floor of the building. These transformers are of the air blast type, manufactured by the General Electric Company, and have a capacity of 250 kilowatts each.

The switching board is of Tennessee marble. The two outside panels control the four generators. The center panel contains the synchronizing indicator lamps, the exciter instruments, and main line switches. The generator panels are provided with voltmeters, current indicators and pressure regulators.

Both the primary and secondary coils of all the step-up transformers are worked in parallel, taking current at 800 volts from the generators and delivering it to the lines at a potential of 11,000 volts. Each generator is provided with a separate and distinct circuit from the power house to Sacramento, and can be worked singly or in parallel. Sturtevant blowers, both at Folsom and Sacramento, each operated by a 2-kilowatt induction motor, furnish air for cooling the transformers when the load is sufficient to cause their heating.

A double pole line, 22.75 miles long, follows the country road and Sacramento Valley Railroad. The poles are of cedar, 40 feet long, 12 inches at the top, and 16 at the but, and are set 6 feet in the ground, 52 to the mile. The cross arms are braced with angle irons, and are 4 inches by 4 inches in cross section and 7 feet long. The transmission circuits are supported on double petticoat porcelain insulators tested to withstand a potential of 25,000 volts. The pole lines each support six No. 1 B. & S. bare copper wires, which effect the transmission at an estimated loss of 10 per cent. at full load. A telephone line is carried on one set of poles. The line is transposed every five poles.

The distributing station is an imposing and substantial 2 story fireproof brick building, and, in addition to the offices of the company, it contains on the ground floor the motor and generator room, in which are located three 3-phase synchronous motors, the electric railway generators, and arc lighting dynamos. The transmission circuits are led direct from the pole lines to the step down transformer chamber, in which are located the various transformer equipments.

Three large 250 kilowatt synchronous motors are supplied with energy from 125 kilowatt transformers, which deliver current at 500 volts. The other transformers step down to 125 volts, the current being distributed over the city on a four wire system, consisting of three wires for the 3-phase current and a fourth or neutral.

The incandescent lighting service is rendered by extensions made between either of the three wires and the neutral, proper care being taken to keep the circuits balanced within reasonable limits. The power service is rendered directly from the 3-phase wiring. Large motors are operated from 500 volt 3-phase wiring; the 125 and 250 volt 4-wire system is used for small motor work and incandescent lighting.

It is hardly necessary to give a recapitulation of the electric equipment of this very extensive plant, and lack of time has prevented my giving you a more complete description of some of the electrical machinery. The plant was started on July 14, 1895, and has been in successful operation day and night ever since, with the exception of some weeks, when low water caused a partial shut down. The useful work performed by this plant can be summed up as follows: It has furnished current for 525 arc lamps, 22,000 incandescent lamps, 1,400 horse power of motors, and 35 motor cars operating 24.5 miles of single track and 17 miles of double track electric railway.

Newcastle-Sacramento Transmission Plant. — The Newcastle-Sacramento Transmission Plant is an interesting plant, illustrative of the utilization of a high head of water. This plant is on the Sierra Nevada divide, northwest of Sacramento. At various points on the canal system of the South Yuba Water Company are "drops" or sudden falls. The most important "drop" is one of 464 feet, of which 400 feet is utilized for driving the power plant of the Central California Electric Company.

The water is carried from a reservoir to the power house, a distance of 6,400 feet, in a 24-inch pipe of riveted sheet steel. The pipe is buried two feet under ground. At the power house the pipe forks, in a heavy cast iron Y, into two 15 inch pipes of No. 6 steel, running to the Ys on the Pelton water wheels. These wheels are of the double pattern, two 48-inch wheels being direct connected to each of the two 400 kilowatt generators. No automatic water wheel governors are used, the regulation being effected manually by the switchboard attendant. Not very close attention is requried, as the plant runs under a load so evenly laid on or taken off that every change can be anticipated, and even a waste of water avoided. The Westinghouse Electric and Manufacturing Company supplied the entire electrical equipment of this plant, consisting of two alternating current 2-phase generators, two exciters, generator switchboard, step-up transformers, 2-phase 500 volts to 3-phase 15,000 volts, 28 miles 3 phase 15,000 volts transmission line, 15,000 volts receiving switchboard, reducing transformers, 3-phase 15,000 volts to 2-phase 2,000 volts, distribution switchboard, 2,000 volt circuits, and transformers for motors and lights.

The two 400 kilowatt generators are of the inwardly projecting field and revolving armature type, and run at a speed of 400 revolutions per minute. They generate 2-phase alternating current of 7,200 alternations per minute at 500 volts. The machines are excited by two 15 kilowatt 125 volt exciters, driven by separate Pelton water wheels. Each generator is connected directly through the switches on the switchboard and fuses to the primary of the step-up transformers, which are connected to transform from 2 phase to 3 phase, and deliver current at 15,000 volts to the transmission line. Four step-up transformers, each of 150 kilowatts, are connected on the Scott system in two pairs of two transformers each for the 2-phase to 3-phase transformation. The pole line is substantial and well constructed. The three wires for the main circuit are No. 4 B & S. bare copper. The insulators are of the Locke pattern, triple petticoated and made to carry a current of very high potential without cracking or puncturing. They are secured to the cross arms by steel pins, thus providing a solid support for the wires. Each end of the transmission line is protected by Wurts non-arcing metal lightning arresters. At the sub station there are three pairs of 75 kilowatt step-down transformers, which receive 3 phase current and deliver 2-phase current at 2,000 volts to the bus-bars of the distributing switchboard. The circuits are supplied with standard transformers for reducing the current from 2,000 volts to 100 or 200 volts as may be required.

In the sub station are two 50-horse power induction motors, direct coupled to 60 light direct current series machines for supplying arc lights. The motors are supplied by two 75-kilowatt transformers, which deliver 2 phase current at 2,000 volts.

Electro Metallurgical Plant at Mercur, Utah.—The next feature to be shown will be the application of electricity for operating the machinery of the largest cyanide mill in the world, the Golden Gate, at Mercur, Utah. The current is generated at Telluride, by water power, and transmitted a distance of 35 miles at a potential of 40,000 volts. The transmission line, which runs through a very rough and unsettled mountainous country, is of very substantial construction, and the insulators were especially designed for safely carrying current at a very high potential. These are the triple petticoated glass insulators known as the "Provo," and are made by the Hemingray Glass Company, of Covington, Ky. They were tested under a potential of 50,000 volts, salt water test, before being shipped from the factory, and not one has ever failed to do its duty. Some have been shot to pieces, but no harm other than the burning off of a few cross arms has ever resulted, and they give entire satisfaction.

Omitting the description of the power plant at Telluride, I will start with the electrical apparatus in and about the mill. All of the electrical apparatus is of Westinghouse manufactnre, and the success that has attended the use of this machinery is noteworthy. The loss of electrical energy in transmission is extremely low, being about 5 per cent.

The current is converted in the transformer house from 40,000 volts, 3 phase, to 220 volts, 2 phase. Current is delivered at the mine at $60 per horse power per year, with a minimum consumption of 300 horse power stipulated. In the high tension room are the Wurts lightning arresters, the choke coils and the high tension lines. Special care is taken in insulating.

The ore is hoisted by a 150 horse power motor, Type C, direct connected to hoist. The crushers weigh 20 tons each, and have a combined capacity of 1,500 tons daily. They are operated by two 50 horse power Westinghouse motors, Type C. Another of these 50-horse power motors operates the roaster and ore converter. A 20 horse power Westinghouse Type C motor at the same mill drives a centrifugal pump. The plant is operated entirely by 2 phase induction motors, aggregating 700-horse power, all of Westinghouse Type C.

While illustrating the applications of electricity to mining, I will call attention to the General Electric Company's mining drills and mining locomotives. One of these, of which I show a view, weighs about 6½ tons and has a draw bar pull of 1,500 pounds, on the level at 6 miles per hour. I show you also the electric hoist in the Free Silver Mine, at Aspen, Col. This is said to be the largest electrical hoist in the world. The electrical equipment consists of one General Electric Company's 100 kilowatt multipolar motor, with a speed of 550 revolutions per minute, and a smaller motor of similar type of 60 kilowatts and a speed of 475 revolutions per minute. The smaller motor can be thrown in gear with the main hoist motor when the load is unusually heavy.

(To be Concluded.)

27.68.

[By Mr. Henry O'Connor, C. E., in *Jour. of Gas Lighting.*]

The heading of this article is somewhat peculiar, and to some, perhaps, unintelligible; but if examined it will be seen to have a special interest to all students of gas engineering problems. We are all accustomed to carry in our heads certain figures for simple calculations such as π, or the ratio of the diameter of a circle to its circumference, or 3.1416, and the area, 0.7854. But the figures now under notice are of equal importance to the gas engineer. Let us then inquire what they mean. A column of water 27.68 inches high, 1 inch broad, and 1 inch thick, weighs exactly 1 pound. This can be easily worked out from the usual formula. One cubic foot of water weighs 62.425 pounds, therefore 1,728 cubic inches (1 cubic foot) divided by 62.425 equals 27.68. So much for the data. Now let us see what use the gas engineer can make of them. We have learned that a column of water of 1 square inch area and 27.68 inches high equals 1 pound weight. Then if we place this column resting on this 1 square inch area, we have a weight of 1 pound pressing on the 1 square inch, or, as it is generally put, 1 pound per square inch. The gas engineer is accustomed to measure pressures of gas by the height of a column of water, usually expressed in inches and tenths. Then, first and foremost, we learn that 27 inches and nearly 7-tenths pressure of water equals 1 pound per square inch; and this becomes our starting point for many calculations of interest in our profession.

Do we want to know the weight of a gasholder? Then we have only to find its internal area in square inches, multiply this by the number of inches pressure thrown by it, and divided by 27.68, and we have the weight in pounds. The reverse of this, of course, holds good, and is equally simple. If we have the weight and area, we can find the pressure which will be thrown. Thus: The weight of the holder in pounds multiplied by 27.68, and divided by the area in square inches, equals the pressure in inches of water. It should be remembered that in all cases it is the area of the inside of the holder at the water level that should be taken. When balance weights are used to reduce the pressure thrown by a holder, these again are calculated by the same figures. Each inch pressure to be reduced requires a weight of 1 pound for every 27.68 square inches contained in the area of the gasholder; this weight, of course, being divided among the number of counterbalance weights employed. In calculating the strains on the top sheets of gasholders or purifiers, these figures again come into use; the upward pressure of the gas in pounds being found by dividing the number of square inches in the area of the holder by 27.68, and multiplying by the number of inches pressure of water thrown by the holder. To find the strain on the holding down bolts, etc., of a purifier, take the area of the purifier in square inches, multiply by the pressure of the gas, divide by 27.68, and this will equal the upward pressure in pounds due to the gas. From this falls to be deducted the weight of the metal in the cover to get at the actual pull upon the bolts.

If we are designing a station governor and wish to know what weights are required to cause the governor to throw certain pressures on the outlet, we have again to use this figure. Having balanced the bell, we must find the area of it in square inches, and divide this by 27.68, which will give us the weight required for each inch of pressure; the weight for any other pressure being found by a direct proportion sum. The same calculation holds good with reference to a district governor or pressure reducer, and also to a governor for regulating the bye-pass of an exhauster or the steam inlet to its engine. Another method of finding the weight is by taking the quantity of water required to cover the area of the top of the bell by 1 inch deep. The weight of this water is the required weight to throw 1 inch pressure. The weight of the cone of a governor, which was often made of sheet metal, must be such that it will more than exceed the upward pressure of the gas, or the cone will close the aperture in the seat. Thus a cone measuring 10 inches diameter at the base must weigh more than 2.8 pounds for each 1 inch inlet pressure, or the upward tendency of the gas will lift the cone, close the aperture and prevent the passage of the gas.

The compression of gases is usually spoken of in atmospheres; each atmosphere being taken roughly at 15 pounds per square inch. To express this in inches of water, we multiply the 15 by 27.68. More properly this should be 14 706, which is the normal pressure of the atmosphere; but the round figure 15 is usually taken for rough calculations. At the normal pressure, the atmosphere will only support a column of water 33 9 feet high, because this height in inches (say, 407) divided by 27.68, the number of inches supported by each pound pressure, equals 14.706, the number of pounds pressure of the atmosphere. Mercury, however, is some 13 6 times as heavy as water; hence only 2 035 inches of mercury equals 1 pound per square inch. Therefore a column of mercury 29 92 inches high represents the pressure of the atmosphere in the same way as 33.9 feet head of water, because 13.6 divided into 27.68 equals 2.035, and 13.6 divided into 33.9 feet, or 407 inches, equals 29.92.

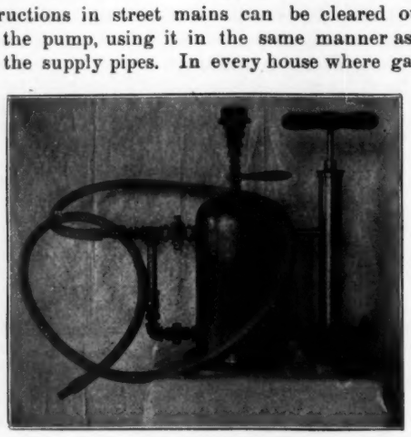
For the pressure on gasholder or other tanks, these figures again help us. For every 27.68 inches depth of water, there is a pressure of 1 pound on every square inch of the bottom of the tank. Thus a tank 830.4 inches deep has a pressure of 30 lbs. on every square inch of the bottom. For the pressure on the sides we have, at 27.68 inches deep, 1 lb.; at 55.36 inches deep, 2 lbs.; at 83.04 inches deep, 3 lbs.; and so on. A tank of water is placed so many feet above its outlet. Then the pressure at the outlet is 1 lb. for each 27.68 inches that the tank is above the outlet, or, to speak strictly accurately, that the surface of the water in the tank is above the outlet. Pipes are usually tested to so many feet head of water. This can be translated into pounds per square inch by the same figures. Divide the height in inches by 27.68, and we have the number of pounds per square inch at which they were tested. Thus 300 feet head equals 130.05 lbs. per square inch.

The preceding instances of the usefulness of these figures will serve to show their importance. They are, however, only examples; and the student will find a number of other calculations based on the same foundation. Sufficient, however, has been said, it is believed, to cause some at least to carry these figures in their mind, and to enable them to apply them where required.

The Horton Combination Pump for Cleaning Services.

The illustration shows a combination pump for clearing supply pipes from house to street main, which is the invention of Mr. George W. Horton, Jr., of Providence, R. I. In describing its effectiveness Mr. Horton says: It can be charged with naphtha for forcing through the supply pipe into the main pipe, leaving the former as clean and clear as when new, completely annihilating naphthalene. It may also be filled with alcohol during the troublous times of frost. Pass a small quantity of alcohol into the hose pipe, shut off the bottom gas cock on pump, then pump up the air and "let it go," throwing the alcohol into the supply pipe and cleaning it thoroughly. The pump can be filled with the liquid before leaving the works, so the workman is not obliged to carry any other vessels, and the chamber filled with alcohol will carry sufficient to clear out a good many supplies. Any ordinary

sort of obstructions in street mains can be cleared out of them by means of the pump, using it in the same manner as it is used in cleaning out the supply pipes. In every house where gas is used put



in the liquid and wash out of main into drip box; then pump drip box and the main will be as clean as when new.

Concerning Assistants.

Engineering Record in a recent issue, in editorial comment on "Assistants," said:

A few days ago a number of prominent engineers were discussing the troubles into which another member of the profession had fallen. His plans for a certain large undertaking had not agreed among themselves, with the directions given him at the outset, or with the work done by other technical advisors of the company which retained him. It was an open secret that he had been dropped by the company retaining him, yet every one admitted his unsual knowledge of engineering subjects and his industry. The men discussing the case said it was a "hard" one, and showed the company did not know what it was about in letting such a valuable man go.

The managers of the company are men interested in more than one commercial venture. In one way or another they know by the final test of their check books what it costs to build and run street railways, electric and gas lighting plants, water companies and large shops. They may not be able to define virtual gradients, follow a demonstration in thermodynamics, or figure the discharge of a submerged orifice; even if they could, they have no time for such things. But when they retain a civil engineer to plan certain important works, and his plans are not ready in the time he asks for the work; when the plans finally submitted are found to contain mistakes liable to produce a loss of thousands of dollars, and throw out the work of the mechanical engineer and chemist; when the only excuse offered for the delays and blunders is the plea that the available time was too short to permit the engineer to check over all the plans personally; when these conditions are apparent to real men of affairs, justice to the stockholders obliges them to drop the bungler, for such he is, immediately.

The company is paying for work, not excuses. If the engineer engages poor assistants, he should get competent ones in their place. It is this subject of assistants which engineers frequently fail to appreciate properly in their early days. It is not intended to read a lesson here on the importance of faithfulness, for the graduating season is past and this is not a Sunday paper. But the "hard" experience of the engineer suggests a few ideas which may prove useful to some young men.

The marked characteristic of the present time is the specialization by which each man does only the best work he is fitted to turn out. The directors of the company hold their positions because they know how to manage large affairs successfully. Suppose the engineer they discharged was a stockholder of the company and received an annual statement like this: "Your Board regrets to announce that through the incompetence of one of its engineers, about $25,000 had to be spent to rectify his mistakes. One of its most trusted bookkeepers has taken about the same amount to Canada without the Board's consent, and an error of the auditing department last year makes it necessary to transfer $50,000 from Surplus to Profit and Loss. Your Board regrets these facts, but cannot see how they could be avoided, for it is unable in a 24 hour day to do all the work of the business personally, and thus avoid mistakes." How would the engineer-stockholder like that?

In such an era of specialism, the responsibility of a man is highly important. The foreman is over the journeymen, the superintendent is over the foremen, the manager over the superintendents, and the directors over all. Each man fits in a special place; if he does not fit, the machine runs hard, no one works to the best advantage, and profits are cut down. The men at the top are there very largely because they know how to get and retain good assistants. They have no time to do the work themselves; their skill lies in selecting others who can be relied on to do it. They never ask to be excused for poor work on the ground they have been unable to do it personally; being real men, they know that their salaries are larger than those of their subordinates only because they are able to keep their departments running properly. They recognize and acknowledge their responsibilities.

So the young engineer is strongly advised to fall into the habit of gauging the work of everyone with whom he comes in contact. If he is successful he will have many men under him sooner or later, and the measure of his success will be the result of his ability to pick the right assistants for each position. If he has kept his eyes open he will know personally of trustworthy men for every place, understand their weak points and their strength, and have an organization where no man does anything but the best that lies in him.

The complaint of poor assistants is a boomerang. It writes the complainant down in large letters as himself poorly fitted for his responsibilities. The streets are full of men looking for every sort of a place. Any one can engage a staff of men with yards of testimonials as to their value. But it takes a shrewd man to engage a good staff of really suitable men, for whose work he will be responsible. Men for minor places are readily found; men for places of real responsibility in large affairs are scarce. They command the large salaries we all wish to have. But they have the responsibility because they have learned its secret, the ability to select and direct assistants. So the young graduate will do well to study the successful men about him, not their mannerisms and eccentricities, but rather the real source of their power. From each successful man he can learn something, and with this knowledge, tact, technical experience and an acquaintance with the real abilities of all the men with whom he has worked, he will soon be fitted for responsibility himself.

Sometimes he will have to struggle with a ready-made staff, a hold-over lot of half pensioners who must be retained for one reason or another. Then he has an opportunity to show his real value, to take what others could not direct successfully, to bring out the best that lies in something which is not good from any point of view. The work will be full of trial and tribulation, vexation of spirit will be his lot every day, yet the training is the best imaginable. Sooner or later it will be noticed by men who have gone successfully through similar difficulties with moribund undertakings, greater opportunities will come to him unsought, and he will have established a reputation for responsibility. These places are the hardest of any to fill successfully, yet the young man who can win success with previously unsuccessful material need have no fear for the future. But to be successful he must give up for a time most things that make life worth living.

Acetylene Gas Considered by a Fireman.

At the 27th annual convention of Fire Engineers (held in Syracuse, N. Y., the 22d ult.), one of the topics discussed was: "The dangers to be encountered and the best methods of fighting fires produced, or likely to occur, from acetylene gas or calcium carbide, with illustrations." The "topic" was presented by Mr. William McDevitt, Chief of the Electrical Department, Phila., Pa., who said:

In describing this new illuminant, it is not intended that the illustrations about to be shown are to act as a scare; but as a knowledge of the process by which the gas is made is not general, owing to the limited extent of its use thus far, it is but just that you should be acquainted with the dangerous properties of calcium carbide, from which the gas is made, so that when brought in contact with it in your calling you can act judiciously.

Acetylene gas, produced from calcium carbide, although recently introduced, is not new, having been known by scientists in their laboratory experience for a number of years, but as the making of the carbide required heat of greater intensity than can be furnished by fire, it was not until the invention of the electric furnace that the material could be produced in quantities for commercial use.

Having personally visited the carbide factory at Niagara Falls, I watched the process in its different stages. The carbide is made from a mixture of two parts of lime and one of coke, which are ground and mixed together in the form of powder, and then put into a specially devised furnace where the two mixed substances are fused or melted by

the intense heat (4,000°) of a powerful electric arc which is formed amidst the powder. After cooling, the material is crushed and broken up into small lumps, appearing, as you see, a gray colored crystal or stone. It is then packed in large iron water-tight drums for shipment, for use with isolated lighting machines, and also in smaller packages for lantern use. The carbide is unaffected by fire. It has an affinity for moisture, even for that of the atmosphere, which disintegrates and crumbles it in a manner similar to that which occurs during the air slacking of lime. With the carbide, such action destroys its gaseous property. In contact with water, this gas is given off profusely, the action being a combining of the oxygen of the water with the calcium of the calcic carbide, forming oxide of calcium, and the hydrogen of the water uniting with the carbide producing acetylene, the residue left being the lime.

As to the dangerous properties of the gas itself, they differ very little from those of other illuminating gases, so we will leave these features and take up the more important ones of the action and effects in the producing of the gas, including that of the generating of heat.

You will observe that when the carbide is attacked with water or almost any fluid containing a large percentage of water, gas is given off, and, like any other illuminating gas, if mixed with air and ignited it forms a high explosive. You will also notice that, notwithstanding the absorbent nature of the carbide, when pouring water upon it, much of the water is driven off in the form of steam, owing to the intense heat generated by the chemical action. With certain conditions the heat can attain a dangerous degree, and upon my asserting to a dealer in the material the possibility of spontaneous combustion originating in a large body of wet carbide, the assertion was not only disputed, but facilities were offered me to either prove or dispel such a theory. The offer being accepted, a test was made on the premises under conditions that might possibly arise wherever carbide was carelessly stored. A half barrel was filled with carbide, which was soaked with water, and the gas allowed to escape free. The barrel and contents were then allowed to stand unmolested, and at the end of four hours' time the barrel was found to be on fire and was burned up. Upon an inspection of the carbide the lower portion was found to be a redhot mass. This test illustrated a possibility of fire originating from wet carbide itself leaving a portion of the carbide unexhausted, and the danger that would have resulted from an attempt to extinguish the burning woodwork with water, which, attacking the remaining carbide, would have generated more gas, to be ignited by the fire, and result in an explosion.

A striking illustration of the dangers which may arise through ignorance of the nature of calcium carbide and the consequent exposure of firemen to its explosive properties was experienced in Philadelphia several months ago, where a quantity of calcium carbide, thought to be worthless, was thrown out of a building into the ruins of an adjacent building that had been recently burned to the ground. The carbide was held in four cans, each containing fifty pounds, and in their descent the cans were broken, allowing the carbide to be exposed to a fall of rain. In some manner, perhaps, by spontaneous action, the gas given off was ignited and a terrific explosion followed, which shattered windows of houses within a block. Upon the arrival of the firemen, they, not knowing the nature of the burning material, directed a stream of water on the fire, resulting in an immense outburst of flaming gas, which extended out into the street, enveloping the firemen in a sheet of fire, and burning a number of them about the face and hands. To add to this exciting experience, a succession of violent explosions occurred, the reports resembling those of bombs, which were heard throughout the city. Finally, Chief Engineer Baxter, detecting the odor of acetylene, withdrew the streams of water, and, as the carbide had been pretty well exhausted, and the fire could do little harm, the burning carbide was allowed to die out of itself.

Having described and illustrated the dangerous properties of calcium carbide, you will see that, in attempting to battle with a fire among this material, our old friend water and our chemicals desert us, and furnish aid to the enemy, and, while there may be some solution which is effective as an extinguisher, but foreign to our equipment, we must adopt other methods and suggest other weapons which may possibly be at hand. You will observe that, upon pouring a limited quantity of the carbide and igniting the gas, the flame will decrease and die out as fast as the affected carbide is exhausted. Therefore, if upon gaining access to a quantity of burning carbide where the flames have not communicated to surroundings, it is best to leave the fire exhaust itself. A boiling action denotes an excess of water, and, consequently, a violent flame. In such a case, if the flame or heat assumes dangerous proportions, smothering of the fire is the best plan to pursue. This may be done with loose earth, soda, ashes, sand, or any substance that will act as a coating to the burning carbide. But, in case of a successful extinguishing of the flame by smothering, you will observe that, in doing this, the gas is still given off, and care must be taken against its being ignited again by a small lurking fire remaining in the mass, or from the flame of a nearby light or a lighted lantern in the hand.

But, perhaps, the greatest danger to be encountered is where calcium carbide may be stored in a burning building or an adjoining one without your knowledge, or if so, at an inaccessible point. The danger of an explosion in such a case might arise from a direct exposure of the carbide or the breaking of the vessels containing it from the effect of the fire or falling material and consequent exposure of the carbide to the action of the water thrown into the burning building, the results of which cannot be foretold. In such a case, a detection of the odor of free acetylene, which resembles that of garlic, should be a signal for the seeking of a safe standpoint.

Another way in which the gas is furnished is in liquid form—the gas from the carbide being compressed into a liquid, as you see by this tube. In this form the gas is held in steel tubes about five feet long and five inches in diameter. The liquid is held at a pressure of from 1,000 to 1,200 pounds, but, when connected to house piping, this pressure is reduced by regulators to the proper standard. The liquid gas, where released from the cylinders, resumes its original state. Owing to a number of fatal accidents occurring in workshops where the tubes of gas were being handled, the manufacture of the liquid gas has been discontinued until further research can be made to insure greater safety with its use. In conclusion, you can readily see that much of the dangers shown can be lessened by restricting the quantity and regulating the method of keeping calcium carbide. In bulk form the material should be held in an outside structure, either specially built or adapted for the purpose. When kept for sale within any building, whatever quantity may be allowed should be divided into small, hermetically sealed packages, not to be opened on the premises nor allowed to be kept in a cellar. In any case, where carbide is stored or sold, the fire department officials should be notified of the fact, and the locating of the material should be subject to their approval.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. William T. Morris, of Penn Yan, N.Y., and Mr. W.W. Miller, of Wellsboro, Pa., have purchased the entire stock of the Homer and Cortland (N. Y.) Gas Light Company, and took possession of the property on the 1st inst.

The following communication, from Mr. George Mant, of Camden, N. J., came to hand the 5th inst.:

To the Editors American Gas Light Journal: In your issue of August 28th last I find printed a communication, emanating from Messrs. Biggs & Wall, of London, respecting a "Rapid Manual Charging Machine." If your readers will kindly refer to the Journal of January 26th, 1896, they will note that I communicated a special charging apparatus at that time to your valuable paper. I may add that I really commenced experimenting with this taper scoop, in 1885, at the Beckton works of the Gas Light and Coke Company, London, England, and fully described same in September, 1886. The actuating gear shown in your issue of August 28th last has actually been in existence at the South Shields gas works for more than 30 years. In my arrangement of gear I prefer to charge the retorts horizontally and not vertically, which does away with the lifting of the scoops, etc., so frequently.

A Correspondent in Boston, Mass., forwards the following: "Frank Curtis, of the North Adams (Mass.) Gas Company recently lost a coat in a peculiar manner. Upon entering his house he hung the coat on an incandescent lamp, which projected from the wall. When the current was turned on the coat was set on fire, but an early discovery of the condition of affairs prevented a serious flaming."

The Henri Nestle Company, manufacturers of Nestle's food, is establishing a large plant at Fulton, N. Y., for the production of its specialties in the United States. This firm has its headquarters at Vevay, Switzerland, and before establishing its plant in America had constructed a similar plant in Sweden. The factory at Fulton will be fireproof and of the most modern construction, using steel framework for the floors and roofs with brick side walls, the floors being constructed of concrete supported by steel beams. The Berlin Iron Bridge Company, of East Berlin, Conn., furnished and erected all the steel structural work connected with this building, under the supervision of Dr. H. J. White, consulting engineer for Mr. Henri Nestle.

Mr. Lawrence S. James, of Boston, Mass., has been reappointed Assistant Inspector of Gas and Gas Meters for Massachusetts.

It is reported that another change has occurred in the ownership of the gas, electric light and street railway properties of Norfolk, Va.

A test, on a good working scale, of the Welsbach improved lamp, for the illuminating of streets, etc., is being carried out under the supervision of the authorities of Toledo, O.

It is reported that the Clyde (N. Y.) Gas and Electric Company will try acetylene gas, distributing the same through the old mains of the gas division of that concern.

The City Solicitor has rendered an opinion to the effect that the franchise under which the business of the Mount Pleasant (Ia.) Gas Company is being carried on has expired by limitation. The Company, we believe, contends that its franchise is perpetual. The matter is being adjudicated between the parties in interest.

A correspondent, from whom it is a pleasure to receive "tidings," sends the following, under date of the 5th inst.:

Dear Journal: In your issue of September 4th I note that you compliment Mr. John W. Mish, Secretary, Treasurer and Purchasing Agent of the Lebanon (Pa.) Gas Company, in most flattering terms in relation to the improvements that are being made on its plant. Mr. Mish does not claim all of the credit, for the Company's President (Mr. L. E. Weimer) and Director Grittinner, in conjunction with Superintendent C. F. Smith, were most valuable aids in deciding upon the extensions. A substantial building 57 feet by 34 feet by 25 feet, built of brick, with iron roof trusses and slated, has been erected this season by a local contractor. Messrs. Bartlett, Hayward & Co., of Baltimore, Md., have installed four purifiers, 8 feet by 12 feet by 4 feet, and a station meter, 5 feet by 5 feet, with 10-inch connections. The Western Gas Construction Company, of Fort Wayne, Ind., has the contract for one No. 2 Pelouze and Audouin improved tar extractor, and Messrs. J. H. Gautier & Co., of Jersey City, N. J., have furnished retorts and settings for two benches of 6's, with Flemming furnaces. The cost of improvements this season amounts to $10,000. Taking into account the new retort and condensing house, built three years ago, in connection with the improvements made this season, Lebanon rejoices in the possession of a modern and complete coal gas plant.

The following letter, from Mr. Geo. H. Waring, Jr., of the Kansas City, Missouri, Gas Company, is answered by stating that, where in his inquiry we have used the italicizing of "nitrogen," the word "hydrogen" should be substituted:

Kansas City, Missouri, Gas Company,
Kansas City, Aug. 31st, 1899.

To the Editors American Gas Light Journal: In the Journal, under date of August 21st, you describe "one of the most recent of the improved gas heating devices brought out by the W. M. Crane Company, of New York," viz.: "The Vulcan Hygienic, Double Cylinder Gas Heater." You state that, "In use the air is drawn through the perforations of the outer end, down and over the surface of the water pan, from which it takes up vapor thence carried into the flame, the *nitrogen* of the water combining to aid combustion." I can't understand how nitrogen could aid combustion, or how this nitrogen came to be in the water. Nitrogen does not aid combustion, neither does pure water contain nitrogen. I judge therefore, that you must have intended to state something else than what you did. I am very much interested in gas heaters, but am unable to see in what way the water will be of any benefit, for my experience has been that the presence of moisture and carbonic acid (the products of combustion of the gas) are the greatest objections to the gas heater. You will, therefore, confer a great favor by going into this matter a little further and more fully, as I am sure there are others who are as deeply interested in this new device as I am. No doubt this is a very good heater, but your explanation does not show why it is such, so far as the water is concerned.

The error in the description of the Crane heater should have been self-evident proof that our readers were at fault.

Mr. W. J. Wilkinson, proprietor of the Shelby (O.) Opera House Department Store, informs us that a proposition to establish a gas works in Shelby next spring is being seriously considered. Shelby is a post village of Sharon township, Rockland County, O., at a point 42 miles south of Sandusky and 12 miles northwest of Mansfield. It may be reached by two lines of railroads, has a population of about 4,000, and is a busy, growing center. Its former railroad station title was that of Shelby Junction.

Work on the new plant at Peekskill, N.Y., is progressing satisfactorily, and the Superintendent (Mr. Ralph W. Cook) contends and asserts that it will be a certainty that the new gas supply of Senator Depew's "own town" will be laid on before November 15.

The contract for the reconstruction of the generating department of the Alexandria (Va.) City Gas Works has been awarded to the Baltimore Retort and Firebrick Company. The contract covers the renewing of 3 benches of 7's, and we hope the other contracts for the betterment of the plant—notably in the instance of purification—will shortly be signed.

Engineering Record reports that wandering electricity from a traveling crane in the works of the Corliss Steam Engine Company injured one of the workmen some time ago. He sued the Company for damages and recently obtained a decision in his favor in the Rhode Island Supreme Court. The Court decided that the accident was caused primarily by the contact outside the works of high tension wires with the leaders for the Crane service. Before the accident the men had been shocked a number of times, and rubber gloves had, therefore, been furnished them, but shocks were also felt after the accident. The Court said: "These shocks were notice to the defendant of the leakage of electricity from the motor to the chain, and we also notice that if, from any cause, a sufficient current of electricity was brought to the motor, the leakage might be sufficient not only to charge the lifting chain but also the hauling chain or other metallic portions of the crane unless properly insulated, with a dangerous current. Having this notice, we think the defendant was bound to have made the insulation between the motor and the hauling chain so complete that the use of the hauling chain would have involved no risk of injury by electricity."

We now have it, on the authority of the Wilmington (Del.) *Republican*, that the Bay State Gas Company, of Delaware, "has bought twelve properties adjoining the property of the Wilmington Coal Gas Company," the idea being that the "properties" are to be used as a site for a large electric lighting station. We hope the Bay State Gas Company has not forgotten its experience in connection with its proposed supply of gas in Wilmington, through the agency of the Oxy-Hydrogen Gas Company. In fact, it cannot have so short a recollection, in that, although it has a gas works, it has not supplied as yet any gas.

A correspondent writes that a deed has been recorded under which all the property of the Raleigh (N. C.) Gas Company has been transferred to the Standard Gas and Electric Company, of Raleigh. The considerations named were: 1,000 shares (par value, $100 each) of the stock, and $60,000 first mortgage gold bonds (5 per cent. per annum) of the Standard Gas and Electric Company. The transfer was an absolute one.

The Bay City (Mich.) *Tribune* of recent date says that articles of association of the Bay City Gas Company have been filed. The capital stock of the Company is returned at $250,000, the main office is to be in Bay City, and those chiefly interested are Messrs. S. R. Bertron, R. G. Kennedy, L. C. Heckenroth, James Todd and James E. Keeler, all of this city. The filed articles thus declare the purposes of the Company: "To manufacture, produce, sell, furnish and supply gas and electricity for public and private lighting, fuel and other purposes, to and in the city of Bay City and its inhabitants, firms and corporations, and to any other town, city or village and the inhabitants thereof to whom gas and electricity may be conducted."

The following is from a recent issue of the Chicago (Ills.) *News*: "The Peoples Gas Light and Coke Company has paid the city $15,589.02, being the 3½ per cent. bonus on sales of gas to private consumers during the second quarter of 1899. The sales, therefore, amounted to $1,312,543, and the Company's income from manufactured gas, aside from that taken by the city, for the first half of this year, compares with the preceding year as follows:

	1899.	1898.
First quarter	1,545,211	1,436,227
Second quarter	1,302,543	1,181,462
Half year	2,847,751	2,617,689

The increase for the six months was $230,065, or 8 per cent., while the increase for the second quarter was over 10 per cent. Sales of fuel gas also have shown a large increase during the 6 months and will show a still larger gain during the latter half of the year. With the same ratio of gain for the year as was shown during the six months the sales of manufactured gas would amount to $5,800,000 for the twelve months. Sales to the city will be about $600,000, and it is figured that the sales of fuel (natural) gas and the miscellaneous receipts will bring the gross receipts up to at least $7,750,000, leaving net income applicable to the stock equal to a fraction over 7 per cent."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, SEPT. 11, 1899.

The Market for Gas Securities.

There was no particular change in the market for city gas shares, steadiness having been the prevailing feature. Consolidated sold beyond 194 and down to 189, with a sharp recovery to-day (Friday) to 193 and a fraction so far as the morning trading was concerned; at the close it was 191, and strong. All signs fail in gas war trading, but if our scanning of the situation is at all in line with the indications, the latter all point not to a truce but to absolute capitulation, with the Consolidated people naming the terms. Amsterdams are fairly steady, although its preferred is unaccountably out of proportion in the rating as shown by the common. The Standard series are steady, and inquiry for the common has been made by good people. Of course the quotations for Mutual are merely nominal.

Out-of-town securities are in good demand, notably Lacledes and Western, of Milwaukee. A good thing to watch is the latter, and another one is Madison Gas and Electric. Baltimore Consolidated is strong, at 63¾ to 65. It is worth 75 of anyone's money.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPT. 11.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	191	191½
Central Union, Bonds, 5's.	3,000,000	1,000	107¼	108⅛
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	260	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	
New Amsterdam Gas Co.	13,000,000	100	33¾	34
Preferred	10,000,000	100	58	59¼
Bonds, 5's	11,000,000	1,000	101½	102
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000		112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000		
Standard	5,000,000	100	112	115
Preferred	5,000,000	100	134	138
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	143¾	143
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1⅞	2
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	40	..
" 1st Mtg. 5's	450,000	1,000	95	98
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	8	9½
" " Bonds, 5's	5,250,000	1,000	84	85
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	106	108
Consumers, Jersey City	2,000,000	100	100	..
" Bonds	600,000	1,000	107½	110
Cincinnati G. & C. Co.	8,500,000	100	191¼	192
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	63¾	64
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	380,000	1,000	87	90
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	99	99½
" Prior Lien 5's	4,546,000	1,000	94¾	94½
Detroit Gas Co., 5's	423,000	1,000	99	99½
" Inc. 5's	31,000	100	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	77	88
" Bonds	2,000,000	..	80	86
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co	250,000	50	50	..
" 1st Mtg. 5's	250,000	1,000	96	100
Jersey City	750,000	20	225	275
Lafayette Gas Co., Ind.	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86
Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	66¼	66½
Preferred	2,500,000	100	99	100
Bonds	10,000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	82	85
" 1st Mtg. 6's	350,000	1,000	102	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co	16,000,000	..	50	60
Bonds, 6's	4,600,000	..	107	108
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	118½	119
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111½	112
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	215	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	70	73
St. Paul Gas Light Co	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96	99
Syracuse, N. Y.	1,750,000	100	..	13
Bonds	1,612 000	1,000	81	84
Washington, D. C	2,400,000	20	280	..
First mortgage 6's	600,000	..	.	..
Western, Milwaukee	4,000,000	100	99	100
Bonds, 5's	3,830,500	.	106	108
Wilmington, Del.	600,000		214	..

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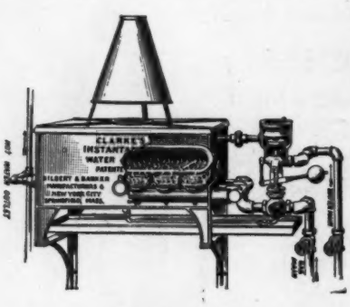

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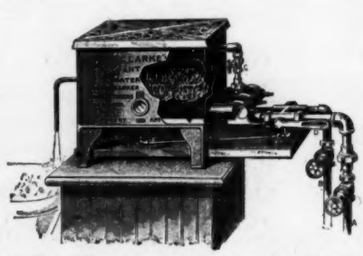

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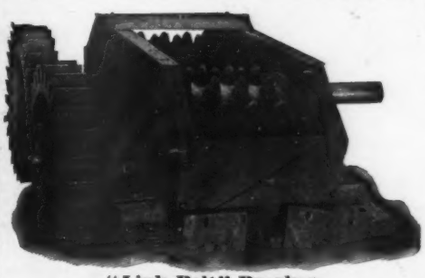

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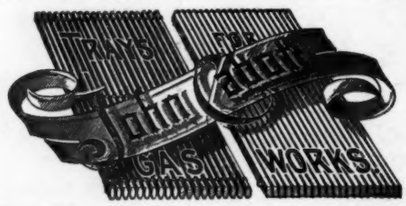

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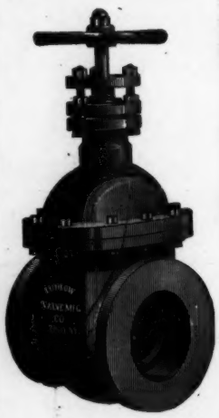

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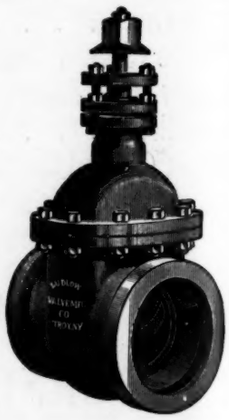

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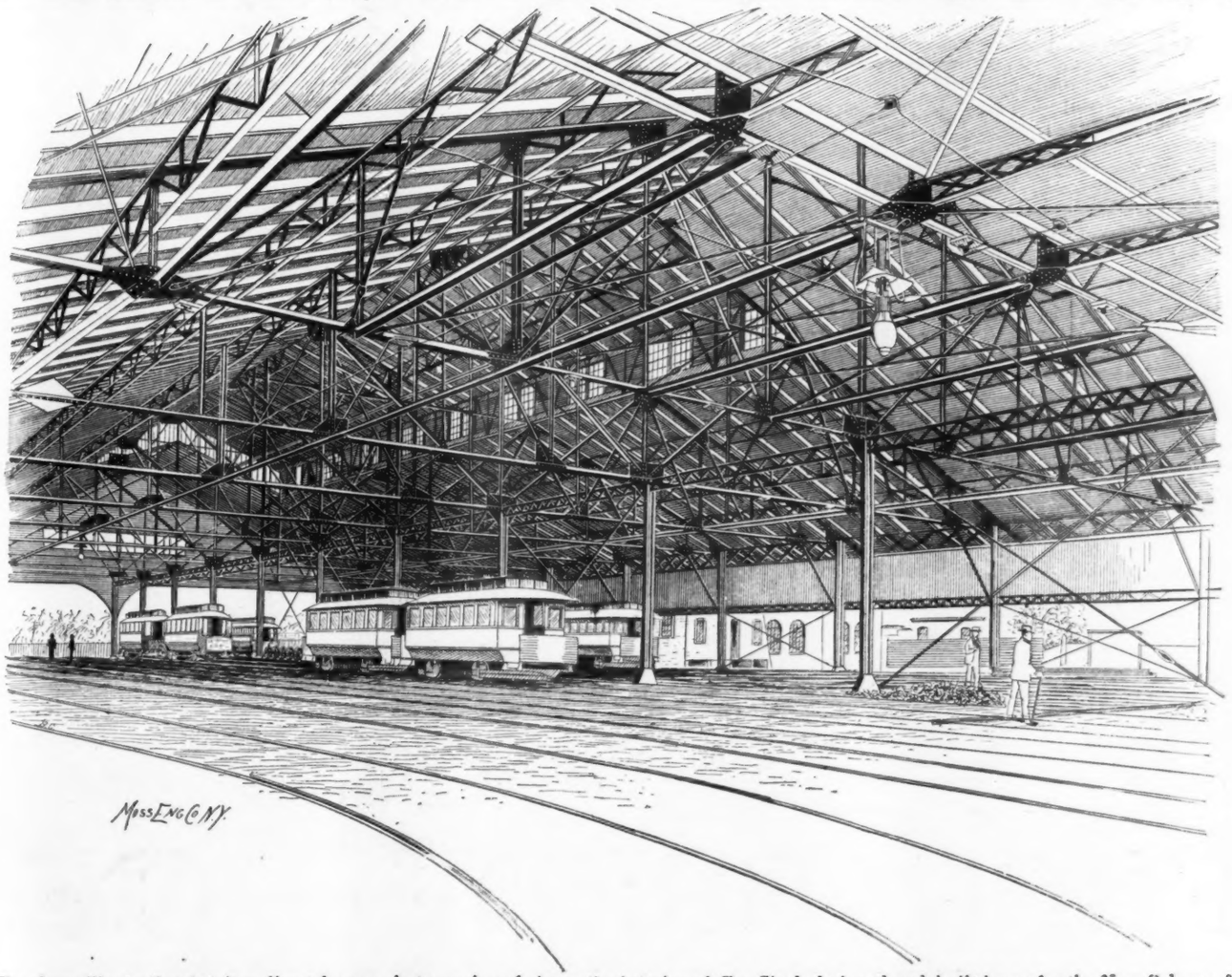

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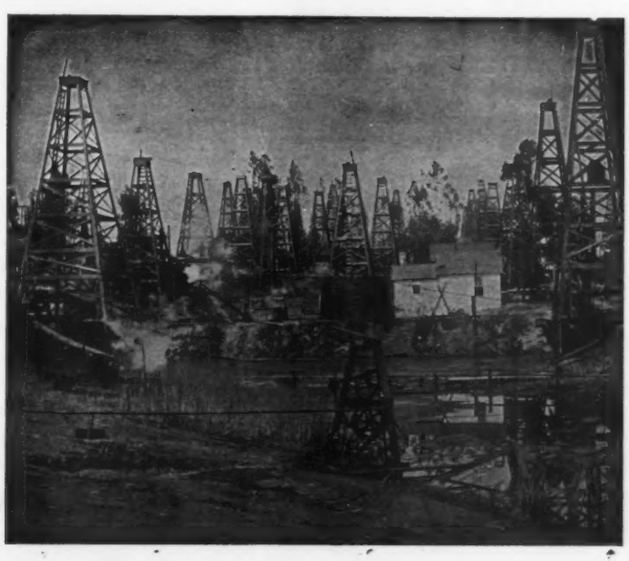

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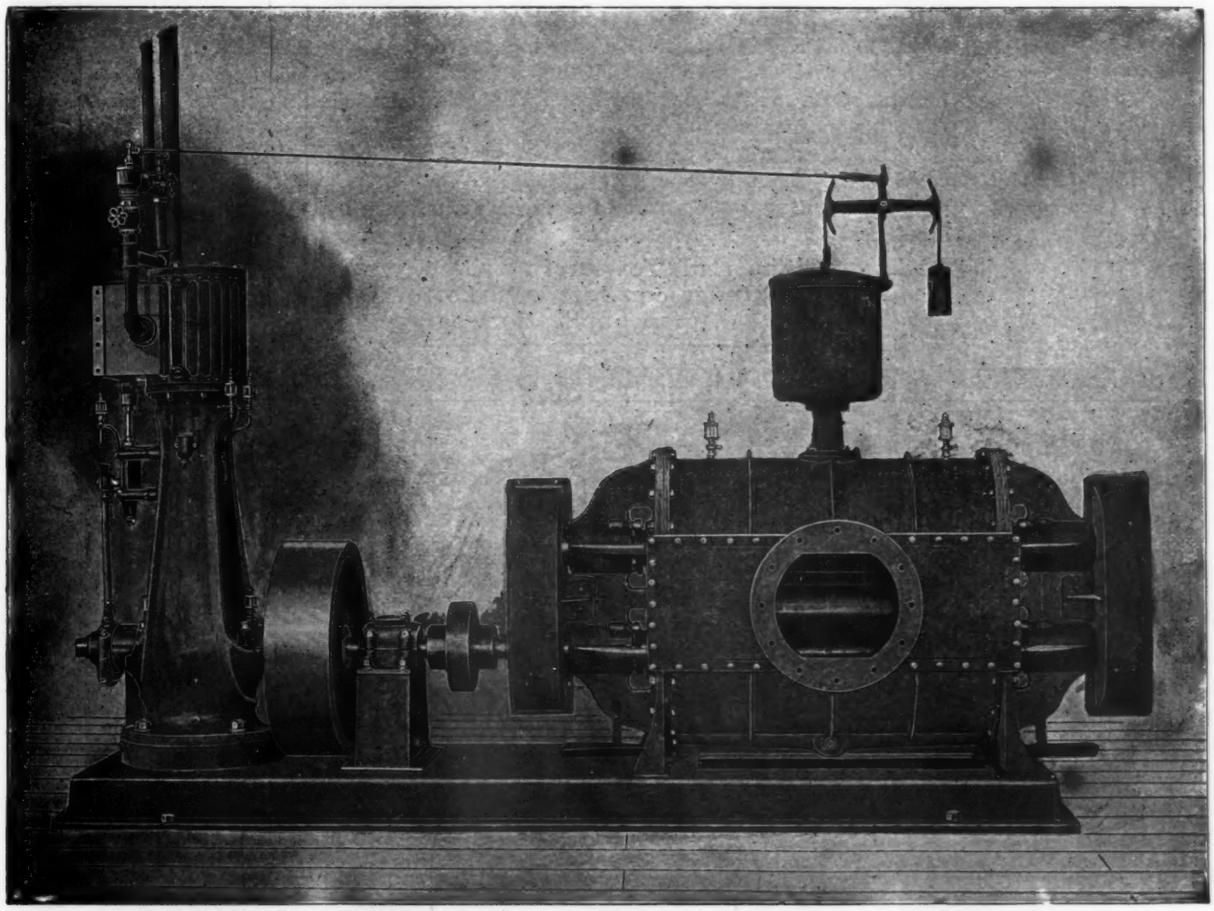

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By G. LIECKFELD, C.E.

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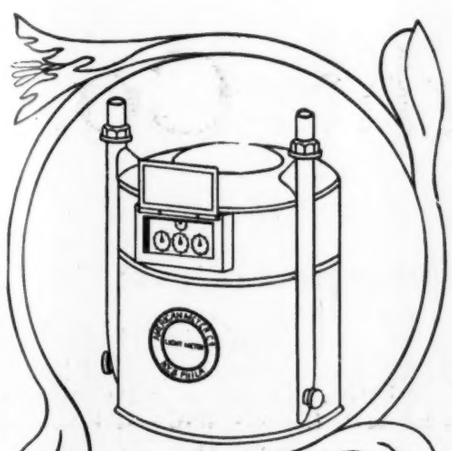

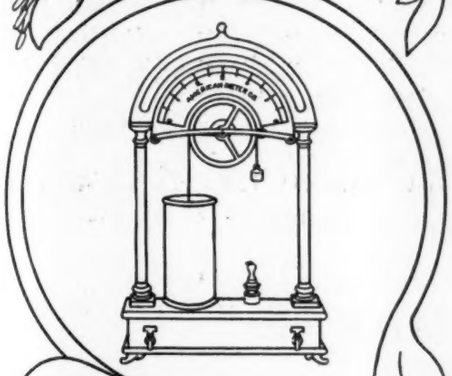

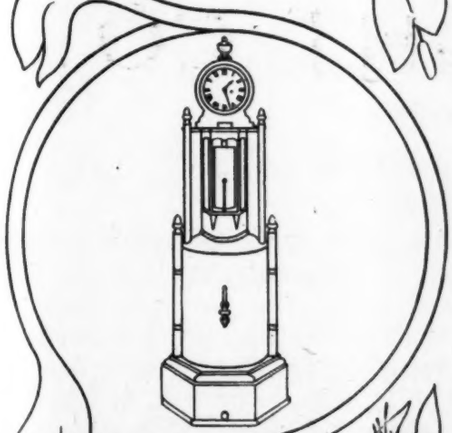

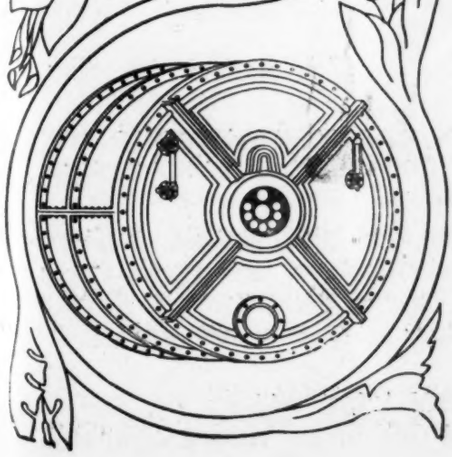

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SAN FRANCISCO.

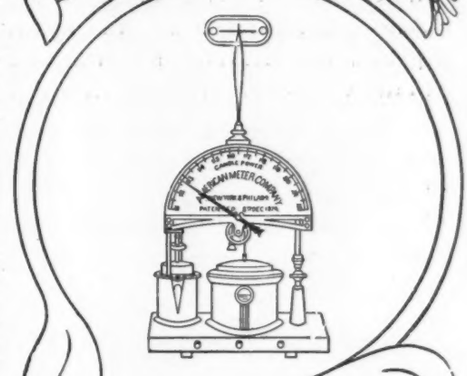
PUBLIC LIGHTING TABLE.

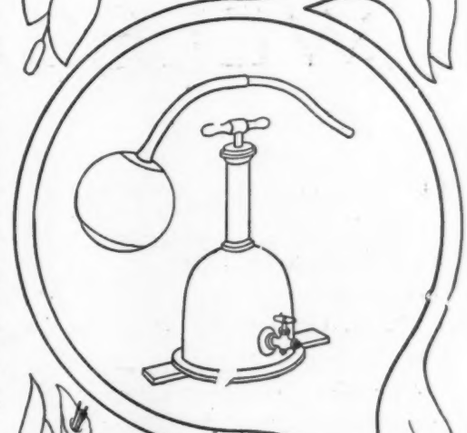
SEPTEMBER, 1899.

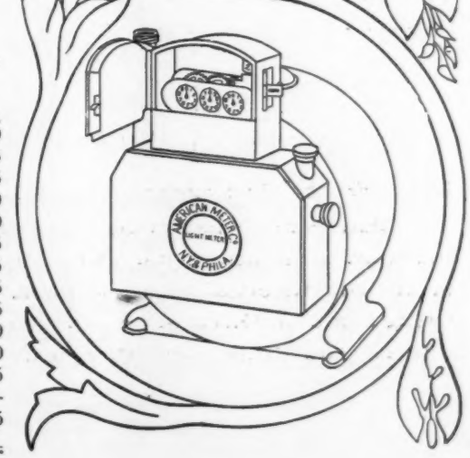
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	7.10 PM	4.30 AM	6.30	4.20
Sat.	2	7.10	4.30	6.30	4.20
Sun.	3	7.00	4.30	6.15	4.30
Mon.	4	7.00 NM	4.30	6.15	4.30
Tue.	5	7.00	4.30	6.15	4.30
Wed.	6	7.00	4.30	6.15	4.30
Thu.	7	7.00	4.30	6.15	4.30
Fri.	8	7.00	4.30	6.15	4.30
Sat.	9	7.10	4.30	6.15	4 30
Sun.	10	7.50	4.40	6.05	4.40
Mon.	11	8.40	4.40	6.05	4.40
Tue.	12	9.40 FQ	4 40	6.05	4.40
Wed.	13	10.40	4 40	6.05	4.40
Thu.	14	11.50	4.40	6.05	4.40
Fri.	15	1.00 AM	4.40	6.05	4.40
Sat.	16	2.20	4.40	6.05	4.40
Sun.	17	3.40	4.40	5.55	4.50
Mon.	18	No L.	No L.	5.55	4.50
Tue.	19	No L. FM	No L.	5.55	4 50
Wed.	20	No L.	No L.	5.55	4.50
Thu.	21	6.30 PM	8.00 PM	5.55	4.50
Fri.	22	6.30	8.40	5.55	4.50
Sat.	23	6.30	9.20	5.55	4.50
Sun.	24	6.20	10.10	5.40	5.00
Mon.	25	6.20	11.00	5.40	5.00
Tue.	26	6.20 LQ	12.00 AM	5.40	5.00
Wed.	27	6.20	1.00	5.40	5.00
Thu.	28	6.20	2.00	5.40	5.00
Fri.	29	6.20	3.00	5.40	5.00
Sat.	30	6.20	3.50	5.40	5.00

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45







OFFICE OF THE

Welsbach Light Co.,

BROAD AND ARCH STREETS,

PHILADELPHIA, PA., June 23, 1899.

To the Stockholders of the Welsbach Light Company:

In answer to the many inquiries received from the stockholders as to whether the Welsbach Light Company is interested in the Kern Light or the Kern Incandescent Gas Light Company, I am authorized by the Board of Directors of this Company to advise you that **THIS COMPANY IS NOT NOW AND NEVER HAS BEEN INTERESTED IN EITHER THE KERN LIGHT OR THE KERN INCANDESCENT GAS LIGHT COMPANY. The Kern Light, or, to designate it more properly, the Kern Bunsen Burner for use with an incandescent mantle, and the United States patents upon which it is based, were offered to this Company, which refused to purchase them upon the advice of its experts, Dr. Charles F. Chandler, of Columbia College, and Dr. Waldron Shapleigh, its Chief Chemist, and of its Patent Council, Mr. John R. Bennett, of New York City.**

This Company is not now and never has been interested in the Welsbach Incandescent Gas Light Company of England, nor is that Company interested in this Company. Your attention is called to the following correspondence, which defines **THE POSITION OF THE UNITED GAS IMPROVEMENT COMPANY**, whose name is mentioned in the advertisements which offer for subscription the stock of the Kern Incandescent Gas Light Company.

WELSBACH LIGHT COMPANY,
W. E. BARROWS, President.

WELSBACH LIGHT CO.,

BROAD AND ARCH STREETS,

PHILADELPHIA, PA., June 23d, 1899.

MR. THOMAS DOLAN, President the United Gas Improvement Company:

DEAR SIR: In yesterday's and to-day's New York and Philadelphia papers appear the advertisements of the International Banking and Trust Company soliciting subscriptions to the Capital Stock of the Kern Incandescent Gas Light Company. Among the names of the Directors of the said Trust Company published in the advertisements referred to appears the name of "George W. Elkins, United Gas Improvement Company, Philadelphia." As the United Gas Improvement Company has been prominently identified with the Welsbach Light ever since its introduction into the United States, the publication of its name in these advertisements, which also contain suggestions hostile to this Company, has greatly disquieted many of our shareholders. If you are willing to give me an authoritative statement of the position of the United Gas Improvement Company I shall be greatly obliged. Very truly yours,

W. E. BARROWS, President Welsbach Light Company.

THE UNITED GAS IMPROVEMENT COMPANY,
Broad and Arch Sts., Philadelphia, June 23d, 1899.

COL. W. E. BARROWS, President Welsbach Light Company:

Dear Sir: Answering your favor of even date, the United Gas Improvement Company is not now and never has been interested either in the Kern Incandescent Gas Light Company or in the International Banking and Trust Company. Mr. George W. Elkins is neither an Officer nor a Director of the United Gas Improvement Company, and does not represent the United Gas Improvement Company. Very truly yours,

THOMAS DOLAN, President,
United Gas Improvement Company.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Under Contract, 1899:

	SETS.	DAILY CAPACITY.
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Derby, Conn.	1	750,000 "
Lowell, Mass.	1	1,000,000 "
Doylestown, Pa.	1	50,000 "
Darby, Pa.	1	400,000 "
Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Stapleton, N. Y.	1	750,000 "
London, O.	1	125,000 "
Chicago, Ills.	2	3,600,000 "
Putnam, Conn.	1	125,000 "
Mansfield, O.	1	250,000 "
Plymouth, Pa.	1	125,000 "
Athens, Pa.	1	125,000 "
Charlotte, N. C.	1	250,000 "
Total	23	15,975,000 "
Previously built	294	187,100,000 "
Grand Total	317	203,075,000 "

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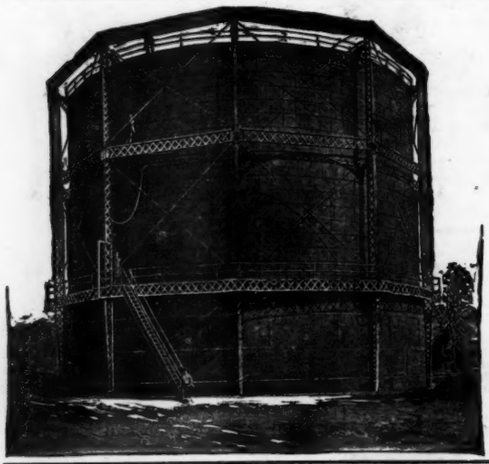

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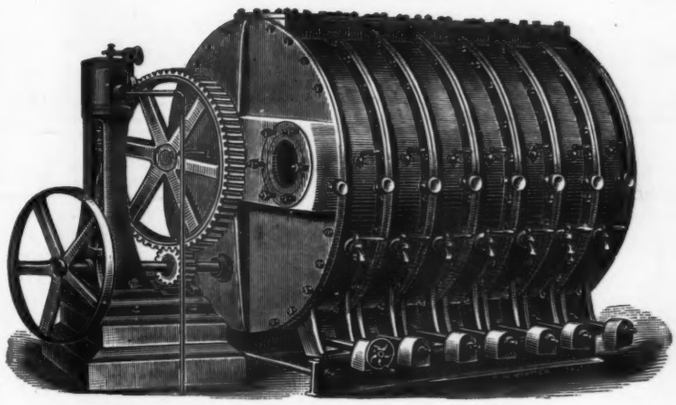

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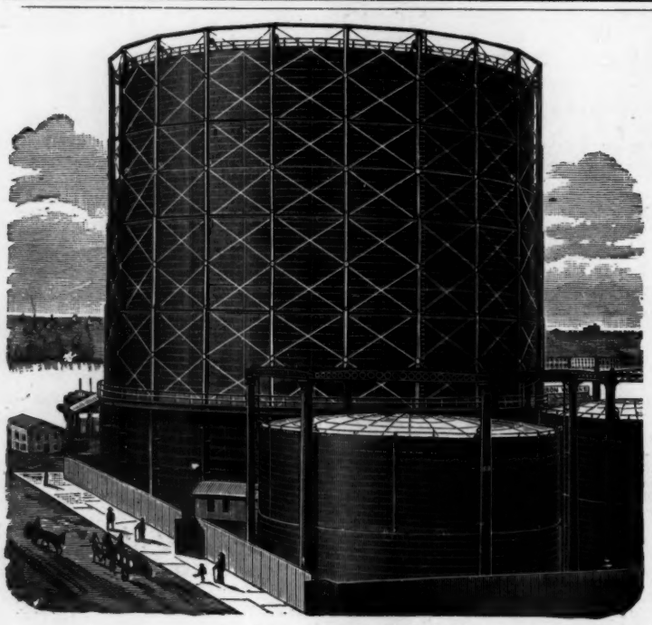

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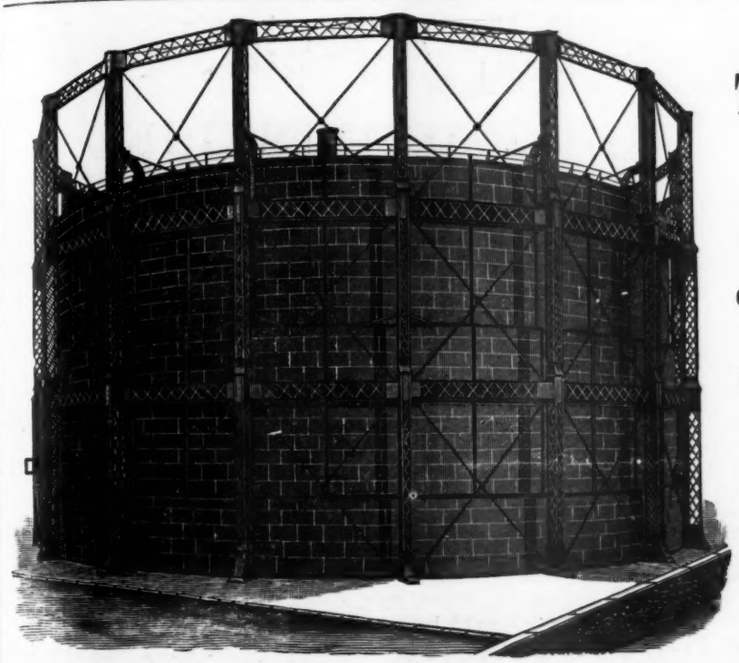

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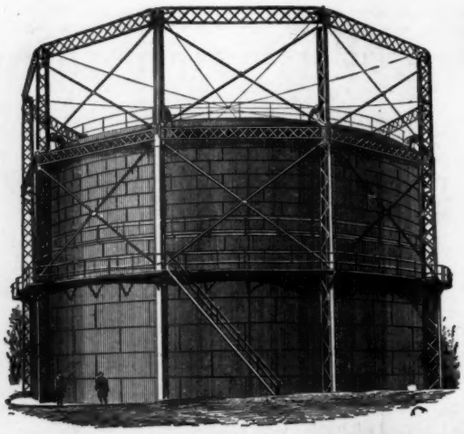

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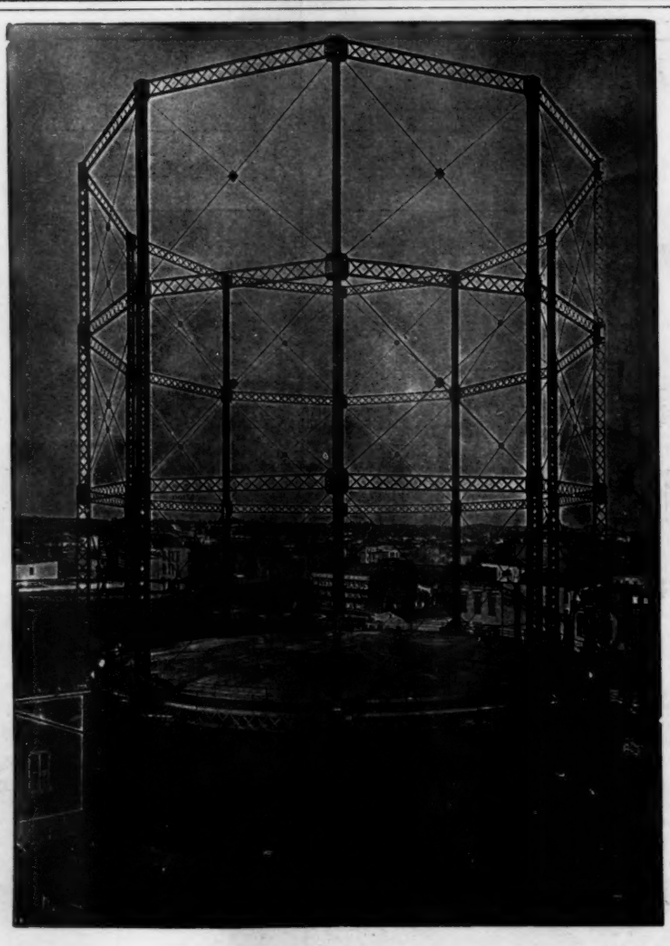

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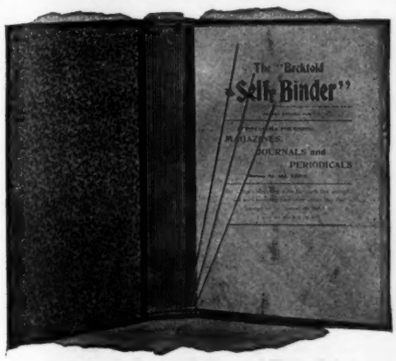

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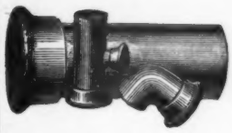

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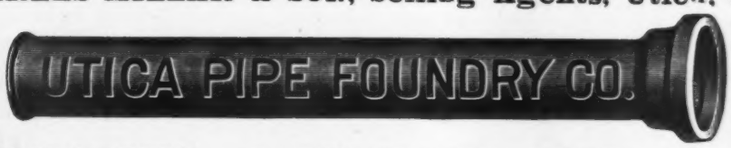

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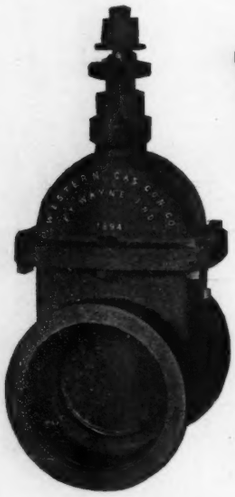

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